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A. C. TRUE, DIRECTOR

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EXPERIMENT STATION RECORD.

VOL. XXXIV. JUNE, 1916. No. 8.

At the time the Hatch Act was passed in 1887, establishing the agricultural experiment stations, no one but a seer could have prophesied the growth and development which these institutions were to undergo or the place they would occupy in the realm of scientific investigation. In fact, it required a keen appreciation of the possibilities of scientific research and a far-sighted vision of the future needs of agriculture to sense the necessity of providing for experiment stations at all. Why, it was asked, should the Federal Government be called upon to found a system for experimentation in agriculture when many persons were still stoutly maintaining that successful farming required only common sense, muscle, and machinery, and that science as applied to this most ancient of arts was theoretical and unpractical and had little to do with the real business of life?

Thirty years ago all research in the United States was relatively restricted in scope and amount, and this country had, in fact, hardly caught its spirit or import. Science itself still seemed to be a purely academic affair which rarely bore any obvious relation to the practical world, and research was deemed a sort of intellectual exercise for a special class. The rigid scholastic conception of pure science as contrasted with applied science was widely prevalent. The ideal investigator was thought of as a kind of crusader who enlisted with almost religious fervor under the banner of truth, with the battle cry of truth for truth's sake and science for science's sake; but too often truth and science were regarded as purely abstractions in the realm of ideas with no necessary connection with the world of concrete things.

Research gained a solid footing earliest in endowed colleges, universities, and institutions established for investigation in special lines, but its development there was generally quite limited. It was largely concerned with abstract propositions, and its activities were regarded with curiosity rather than with comprehension or understanding. Least of all was it looked for at the agricultural colleges, which were expected to interest and instruct their farmer constituents through their model farms and superior live stock, and were thought of by other classes of colleges as being distinctly elementary and vocational rather than for the broad advancement of learning.

How remarkable, therefore, that these same agricultural institutions should in so short a period have become great centers of investigation and in a measure set a pace for it which has been reflected in many other classes of institutions. It is probably not too much to say that they have been the greatest single agency for stimulating research in its varied branches by force of their example and success, their closeness to the people, and the confidence and understanding which they have won for experimental inquiry. Agricultural investigation has shown, as no other class of investigation had previously shown, the direct practical relations of such activity to every-day life and to human welfare, and has popularized it in the mind of the people. This interest has been extended to the various departments of science in general.

With this widespread acceptance and approval of the stations by the general public has come an increasing realization of their achievements and opportunities by the scientific world. The impression formerly more or less current in scientific circles that agricultural investigation was hardly comparable in quality with the research carried on at endowed universities and similar institutions is rapidly becoming dispelled. To-day the stations are not only recognized as important and valued factors in the advancement of knowledge and its application to the improvement of mankind, but as possessing many and unique advantages as fields of opportunity for the man with high scientific attainments and the desire to carry on research.

Conditions have radically altered since the days when station positions were, as a class, too often thought to offer little of promise to such a man. The station staffs have come to include some of the best-trained men in the country. In biology, chemistry, physics, and other sciences, vacancies in the station ranks are being sought by candidates of high qualifications as comparable with, and in some respects even preferable to, opportunities open to them elsewhere. It may be of interest to note briefly some of the reasons for this change of attitude and some of the considerations which now render these positions so attractive.

In the early days of the experiment stations their resources were small and their outlook for development uncertain. They themselves were looked upon as experiments and had first of all to demonstrate their right to existence. A full-fledged system of purely research institutions was impossible under these conditions, and a period of transition was inevitable.

With the small funds at the disposal of the stations it was necessary to practice economy in all directions. Equipment was frequently inadequate and suitable laboratories, library facilities, and similar needs were too often wanting. Even the number of men which an institution could afford to maintain upon its staff was greatly limited.

The field of agriculture, however, was broad and its needs urgent, and in the attempt to cover it the scope of each man's province was correspondingly widened. We thus had at the start such somewhat anomalous titles for heads of departments as agriculturist and horticulturist, and a proportionate scarcity of real specialists.

The station scientist was called upon to do much teaching in the agricultural college, both to four-year students and in short courses. Some effort was made to adjust the demands of his dual functions so that the one would not too greatly interfere with the other, but this was not always arranged primarily from the point of view of the station. As the number of students in the colleges increased, the burden of the instruction staff naturally became even heavier, and to the duties of teaching were added those of organizing departments, advising students, and other administrative requirements.

In order to bring the results of scientific work more speedily before the farmers it was deemed wise to expend some efforts in extension work. The station worker was expected to do more or less speaking at farmers' institutes and similar gatherings, and to prepare popular articles for the farm press, as well as to serve as a sort of consulting expert in answering inquiries for general information and the like. All this still further lessened his opportunity for research.

Even such time as was available for station work was in great demand for a variety of matters which seemed to require immediate attention in spite of their rather simple and elementary character. Individual farmers proposed problems for which they expected and needed an early solution, and some of these problems seemed to merit immediate study, even though it meant a postponement of more fundamental inquiries.

Then again, there was only a very limited body of agricultural knowledge in this country, and to meet this deficiency there were borrowed from Europe results which had already been established by investigators there. Thus, data concerning the nutritive value of feeds and the theoretical nutritive requirements proposed by European investigators were taken almost bodily for application to American conditions, and similar recourse, in the absence of domestic information, was had to European conclusions regarding soil fertility, plant physiology, and the control of fungus diseases. This was, of course, realized to be merely a makeshift to tide over the interval necessary to complete experiments, but none the less it tended to create the impression that the stations were to a considerable degree disseminators of existing information rather than centers of original research.

More discouraging than these material obstacles to the would-be research worker, however, was the uncertainty which prevailed as to the real function of the experiment station and the ultimate develop-

ment of agricultural investigation. On these points the ideas held by the station workers themselves were at variance, and the general public was naturally in even greater need of enlightenment as to what might be done and how much could reasonably be anticipated. Some people, as already indicated, expected little or nothing in a practical way to come from any form of scientific inquiry, but others, with an over-confidence in the immediate effect of the legislation establishing the stations, apparently regarded it as a panacea for all the ills of farming. The stations were looked to for prompt and authoritative answers to practically all questions relating to agriculture, and when urgent problems were presented some impatience was expressed if quick results were not forthcoming. These insistent demands for immediate returns inevitably influenced some station workers against their better judgment to try short-cuts in the solution of a problem in hand, to rely upon superficial methods of inquiry, and to publish the results of their findings too soon. Such practices did much in certain instances to prolong the unfavorable impression as to the thoroughness and accuracy of station work, and even to raise the question as to whether high-grade research in agriculture was a possibility.

Unfortunate and discouraging as were some of the deficiencies and mistakes of the early beginnings, it should not be forgotten that many of them were well-nigh unavoidable. The stations represented a new experiment in establishing research on a popular basis. They were developing for it new relationships and dependencies, winning their way, building a support for their work which would in the end afford larger opportunity. It was not so much that ideals were lacking, although these were not always of the highest, as that the conditions had first to be made right. The public, and not a few individuals, had to be convinced of the practicability of a system of research in agriculture and a foundation laid in public sentiment.

Little by little most of the disadvantages formerly surrounding the stations have been overcome. Increased popular appreciation has brought with it enlarged resources, and these have made possible more adequate equipment, better trained assistants, closer differentiation in both subject matter and kind of activity, relief from a variety of distracting duties, and opportunity for concentration upon problems worthy of study. Fortunate, indeed, is the endowed university or similar institution now possessing superior advantages along these lines.

Statistics recently tabulated by the States Relations Service show that for the fiscal year ended June 30, 1915, the total revenue of the sixty experiment stations reporting was $5,286,382.53. This is an average for each State of over $100,000, equivalent to the interest at

five per cent on an endowment of $2,000,000 each. Some of this, to be sure, is appropriated for regulatory service and other non-research work, yet the showing is still impressive as an indication of their resources and permanent footing.

Data are not at hand as to the funds available for research in privately supported educational institutions, but it is a reasonable assumption that in few instances would those of the stations suffer by comparison as to either adequacy or stability. In addition it may be pointed out that projects financed by the Federal funds are undertaken under definite plans, many of which, especially in the case of the Adams projects, contemplate their continuation for five to ten years or more, under allotments sufficient to guarantee their efficiency and uninterrupted prosecution.

Additions to the equipment of the stations during the year aggregated $1,135,980.04. Of this amount $537,665.45 was for buildings, $40,544.05 for the libraries, and $130,754.74 for apparatus, as well as $85,768.13 for farm implements, $196,781.02 for live stock, and $144,463.65 for miscellaneous purposes. Most of these figures are larger than in previous years, but they are not deemed abnormal, and may fairly be cited as evidence that the stations as a class are providing their staffs with facilities far more adequate than is common, except at a very few special institutions.

The more adequate support of the agricultural colleges, coupled with the passage of the Smith-Lever Act and other provisions for extension work, are largely relieving the station worker of other duties. Of the 1,857 members of the station staffs last year, but 892 were also engaged in instruction and but 166 were assisting in extension work. That as favorable conditions do not always exist elsewhere may be inferred from a recent address of Dr. Jackson, of the University of Minnesota, entitled Obstacles to Research, in which he says that "even more than lack of facilities, lack of time is an obstacle very frequently encountered by university research workers. Many university men are carrying the burden of research and teaching, which, if well done, must encroach upon time absolutely essential for serious research work. In many cases a considerable amount of routine administrative duties, committee work, etc., is added."

Station work has been organized on a more logical basis than formerly, the subject matter has been subdivided, and the services of specialists extensively employed. Instead of an undifferentiated department of horticulture we may now find plant breeders, physiological botanists, pomologists, and the like. Agronomy has resolved itself into soil physics, chemistry, bacteriology, farm crops, etc. At the same time the boundaries between the general sciences have

been broken down as the interrelations of the various branches have become apparent. The physicist has been enlisted in soil investigations, the biologist in studies of the laws of inheritance in plants and animals, the chemist in determining the function of new groups of food constituents, the engineer in the provision and employment of water, etc.

Marked progress has been made in bringing about an enlarged public understanding of the methods of research. It is now generally recognized that the solution of most agricultural problems requires time, and that it can not be safely hurried. We less often hear impatience expressed at the failure to solve a problem in a few months. The general public has better learned to trust the judgment and ability of the station worker, and to await with patience and confidence the completion of his efforts. Likewise, there has come about a realization by scientific men of the fallacy in the old view that there is necessarily an inferiority about work which, to quote President Woodward, of the Carnegie Institution of Washington, "is often designated by the ambiguous word 'practical,' or by the misleading phrase 'applied science,'" and an acknowledgment that "in so far as it deals with facts and principles and substitutes knowledge for ignorance, it is worthy of prompt recognition and unstinted support."

More attractive, however, in the eyes of the true investigator than fine laboratories, or otherwise congenial environment is the opportunity afforded for productive research. In this respect the stations now offer an especially attractive field. Where to such an extent as in agriculture can be found problems of such varied complexity and immediate and wide application? Agriculture in its present stage involves a contest with the elements and with industrial and economic conditions. Its problems are ready-made and pressing, not to be postponed without loss and sometimes hardship. Millions of dollars and the prosperity of whole sections of our country may be at stake in an investigation of a new disease of plants or animals, the utilization of a by-product, or the more intelligent use of the soil. The very size and indispensability of the industry and the difficult character of many of the problems involved in it furnish an unusual inspiration. The subject taxes the ingenuity, the scientific ability, and the acumen of the investigator and gives as large a range for his efforts as any known field of inquiry. Modern agriculture is a harnessing, control, and utilization of the elements and phenomena which operate in accordance with the scientific and economic laws. In its form and content at any stage it exemplifies in a significant degree the status of man's knowledge and mastery of natural forces.

In the early days the demand for immediate practical results was often accompanied with the insistence, even by boards of control and administrative officers, that the experimenters should be chosen primarily because of their practical knowledge of farming or horticulture. But now it is seen that investigators without scientific training are not likely to obtain anything more than superficial or empirical results. Hence the standard of scientific training for station workers is steadily rising. Men with elaborate and advanced training along scientific lines are in demand for the specialized positions now open in the stations. Young men, therefore, have a strong incentive to prepare themselves thoroughly for research in agriculture.

The wide and rapid spread of extension work in agriculture, until it now covers practically all phases of agriculture throughout the United States, is already beginning to increase the opportunities of well-trained men to engage in agricultural research. The large number of well-paid positions opening in the extension work is attracting from the ranks of station workers those who are more interested in popular phases of agricultural work. Thus the opportunity is often given to put in their place better trained men with a more serious interest in research. The extension workers are also creating a broader demand for more complete investigations, the results of which can be used in demonstrations among the farmers or in answering inquiries pressed home upon the extension men now living in close contact with the farmers. As time goes on extension work will inevitably become more highly specialized and the demand for new knowledge to be put to practical use will grow apace. With such a backing of widespread interest in the improvement of agricultural practice based on the results of scientific research, there is every reason to believe that the opportunities for the stations to strengthen and enlarge their researches will steadily grow.

All these facts are becoming widely known and appreciated in the scientific world. They present considerations which count for much among investigators, and explain the prestige which the stations are acquiring as desirable fields of opportunity. It is fortunate that the stations are thus coming into their rightful position, for the unsolved problems in American agriculture are many and intricate and their importance justifies the enlistment of the services of the best-trained scientists of the land in their solution.

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RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The casein and salts of goat's milk, A. W. BOSWORTH and L. L. VAN SLYKE (*New York Sta. Tech. Bul. 46 (1915), pp. 3–15; Jour. Biol. Chem., 24 (1916), No. 3, pp. 173–189*).—Continuing earlier work (E. S. R., 33, p. 660) an investigation was made of the chemical composition of goat's milk.

The casein prepared from goat's milk forms a series of compounds with bases which indicate that its valence, combining proportions, and molecular weight are the same as that of the casein of cow's milk.

The soluble constituents of goat's milk are sugar, potassium, sodium, and chlorin. The albumin, inorganic phosphates, calcium, magnesium, and citrates are partly in suspension and partly in colloidal solution. The fat and casein are entirely in colloidal solution.

The real acidity of the milk, obtained after precipitating the calcium with neutral potassium oxalate, is considerably less than that of cow's milk. Goat's milk, in contrast to cow's and human milk, contains tricalcium phosphate. The total amount of salts in human milk is about one-third that in cow's or goat's milk. The number of different salts appears to be greater in goat's milk, and the amount of chlorids is greater than in either human or cow's milk.

Based on the results of their study, the authors suggest the following as representing, in percentages, the forms in which the constituents may be present in the milk: Total solids 12.34, fat 3.8, milk-sugar 4.5, proteins combined with calcium 3.1, dicalcium phosphate 0.092, tricalcium phosphate 0.062, dimagnesium phosphate 0.068, trimagnesium phosphate 0.024, monopotassium phosphate 0.073, potassium citrate 0.25, potassium chlorid 0.16, calcium chlorid 0.115, and sodium chlorid 0.095.

Analyses of 23 samples of milk from 11 goats are appended.

The formation of protein and humin substances, L. C. MAILLARD (*Genèse des Matières Protéiques et des Matières Humiques. Paris: Masson & Co., 1913, pp. XI+423, pls. 2*).—This volume constitutes an account of the author's researches on the formation of protein and humin substances. It contains an introduction and four main parts, together with a general résumé and conclusions.

Experiments on the synthesis of polypeptids, peptones, and proteins by means of enzyms, E. ABDERHALDEN (*Fermentforsch., 1 (1914), No. 1, pp. 47–54*).—After obtaining negative results in an attempt to synthesize higher products from amino acids through the agency of enzyms, the author claims to have obtained positive results by digesting liver, kidney, thyroid, and lung tissue by gastric, pancreatic, and intestinal juices for three months, after which period the biuret reaction was negative in all cases.

A 20 per cent solution of such a digested product was prepared with physiological salt solution, and after being thoroughly boiled was treated with its own respective organ extract and allowed to stand in the incubator for four weeks. At the end of this time biuret tests were made and found to be negative. The preparations were then allowed to stand for five months at room temperature, at the end of which time biuret reactions were positive and quantitative determinations indicated the formation of protein or intermediate products. The experimental results strongly indicate the specificity of enzyms.

The investigation is being continued.

Studies on anthocyans.—II–X, R. WILLSTÄTTER ET AL. (*Liebigs Ann. Chem., 408 (1915), No. 1, pp. 1–162*).—Continuing the investigation previously noted (E. S. R., 31, p. 324), the following studies are reported:

II. *Coloring matter of the rose, by R. Willstätter and T. J. Nolan (pp. 1–14).*—The authors have found that cyanin, the anthocyan of the rose, is identical with that of the cornflower. The varieties of color are dependent on the reaction of the cell sap, whether acid, neutral, or alkaline. The white and yellow rose contain practically no anthocyan, the rose-colored one a little, while the dark red rose is rich an acid-combined coloring matter, the alkali salt of which determines the color of the cornflower. The identity of the anthocyans was demonstrated by the ultimate chemical analysis and by their physical properties. The preparation of cyanidin ($C_{15}H_{11}O_6Cl$) and its pseudobase ($C_{15}H_{12}O_6.H_2O$) further established their identity.

III. *Coloring matter of the red whortleberry, R. Willstätter and H. Mallison (pp. 15–41).*—Idaein was found to contain the same coloring component, cyanidin, as the rose and cornflower, combined with one molecule of galactose. The coloring matter was extracted from the berries by glacial acetic acid and subsequent precipitation from the extract with ether. It was further purified by isolation as the picrate, from which the chlorid was obtained by treatment with methyl-alcohol hydrochloric acid. This method was adopted as one of the common procedures in the isolation of the anthocyans. On hydrolysis with hydrochloric acid idaein yielded cyanidin chlorid and galactose. The cyanidin, on heating with alkali, decomposed and yielded phloroglucinol and ortho dihydroxy-benzoic acid.

IV. *Coloring matter of the scarlet pelargonium, R. Willstätter and E. K. Bolton (pp. 42–61).*—Scarlet pelargonium was found to contain but one coloring substance, pelargonin, which is a diglucosid. On treatment with hydrochloric acid it yielded glucose and the dye-component, pelargonidin, which is analogous to cyanidin. A sulphate, nitrate, and oxalate of pelargonin were obtained, but the picrate could not be isolated. On treatment with alkali, pelargonidin chlorid yielded phloroglucinol and para-oxy-benzoic acid with a trace of protocatechuic acid.

V. *The anthocyan of the larkspur, R. Willstätter and W. Mieg (pp. 61–82).*—Delphinin, the coloring matter of the larkspur, was isolated either in the free state or as the chlorid. On hydrolysis with hydrochloric acid the delphinin chlorid yielded 2 molecules of glucose, 2 molecules of para-oxy-benzoic acid, and 1 molecule of delphinidin chlorid. This anthocyanidin, on heating with 5 per cent alkali, decomposed into phloroglucinol and probably gallic acid which, at the temperature of the reaction, loses carbon dioxid and yields pyrogallol.

VI. *Coloring matter of the grape and the whortleberry, R. Willstätter and E. H. Zollinger (pp. 83–109).*—Enin, the anthocyan of the grape, was obtained by the usual procedure, and purified by isolating as the picrate. Alcohol or alcoholic hydrochloric acid could also be used as extraction agents. From the picrate the enin chlorid was separated as red or brownish-red crystals. The enin is a monoglucosid and, on hydrolysis, yields 1 molecule of glucose and 1 molecule of enidin chlorid. Heated with hydriodic acid the enidin chlorid loses two methyl groups and yields delphinidin. Decomposed with alkali it gives phloroglucinol and a methyl ester of gallic acid.

Myrtillin was obtained from the whortleberry by alcoholic-hydrochloric acid extraction, and purified by isolation as the picrate or chlorid. On hydrolysis with hydrochloric acid it yielded myrtillidin chlorid in dark-brown pointed prisms.

VII. *Coloring matter of Althaea rosea, R. Willstätter and K. Martin (pp. 110–121).*—The anthocyan, althaein, was isolated by the alcoholic acid extraction. The chlorid, on hydrolysis, yielded myrtillidin chlorid and a sugar which has not as yet been identified as glucose. Heating with 75 per cent alkali produced phloroglucinol and probably gallic acid. By demethylization with hydriodic acid beautiful crystals of delphinidin chlorid were obtained.

VIII. *Coloring matter of the wild mallow, R. Willstätter and W. Mieg (pp. 122–135).*—Malvin, the anthocyan from the wild mallow, was extracted by the usual alcoholic acid procedure. The glucosid, on hydrolysis, yielded malvidin chlorid and glucose. On treatment with hydriodic acid, malvidin yielded delphinidin. The alkali fusion caused a cleavage into phloroglucinol, a trace of a monomethyl ether of phloroglucinol, and probably a monomethyl ether of gallic acid. Tables giving the physical and chemical properties, and showing close relation between the anthocyans and anthocyanidins thus far studied, are included.

IX. *Coloring matter of the peony, R. Willstätter and T. J. Nolan (pp. 136–146).*—Peonin is analogous to cyanin which was isolated from the rose. On hydrolysis it yields 2 molecules of glucose and peonidin chlorid. Demethylization with hydriodic acid gives cyanidin. On decomposition with alkali phloroglucinol was identified, but the acid was apparently decomposed by the high temperature necessary for the reaction. The properties of cyanin, peonin, cyanidin, and peonidin are given in tabular form.

X. *Variations in the coloring matter of flowers, R. Willstätter and H. Mallison (pp. 147–162, figs. 2).*—It is concluded that the variation of colors in flowers depends on (1) the formation of different anthocyans in one plant or even in a single flower, (2) the varying amounts of the coloring matter present, (3) the reaction of the cell sap, and (4) the mixture with yellow pigments. The anthocyans are amphoteric, and experimental evidence indicates that in red flowers they are combined with acids. In violet flowers they exist as neutral coloring matter, and in blue flowers as alkali or other metallic salts. Among the yellow pigments commonly found are the indifferent carotinoids, chiefly carotin and xanthophyll, the flavone colors combined with a sugar, and the so-called "anthochlor" dyes. The methods used for the isolation of the anthocyans and the preparation of the anthocyanins are reviewed.

The phosphoric acid in starch, J. H. Northrup and J. M. Nelson (*Jour. Amer. Chem. Soc., 38 (1916), No. 2, pp. 472–479*).—The results of an investigation of the phosphorus in starch indicated that it is chemically combined in the starch grains and can not be removed in any form by simple extraction with dilute acid. The presence of phosphorus in starch is not due to contamination. A compound of definite composition, containing a carbohydrate and also having a relatively high phosphorus content, was isolated from partially hydrolyzed starch. The possibility that the compound was derived from proteins in the starch was shown to be very remote.

Alfalfa seed oil.—Alfalfa investigation, VI, C. A. Jacobson and A. Holmes (*Jour. Amer. Chem. Soc., 38 (1916), No. 2, pp. 480–485*).—This is a continuation of investigations reported previously (E. S. R., 32, p. 410).

The oil obtained by extraction with gasoline was found to be a drying oil, with the following constants: Refractive index, at 20° C., 1.477; specific gravity, 0.9117 and 0.9149 at 24°; saponification value, 172.3; iodin value, 154.2; acid value, 2.85; acetyl value, 19.8; Reichert-Meissl value, 0.4; unsaponifiable matter, 4.4 per cent; glycerol (by acetin), 1.97 per cent; saponification value of the acetylated oil, 192.2. In its physical properties it resembles safflower oil. The ground seeds, previous to extraction, yielded the following in per-

centage: Moisture, 6.35; protein, 35.88; ether extract, 11.39; carbohydrates, etc., 32.43; crude fiber, 10.52; and ash, 3.43.

The chemistry of yeast and alcoholic fermentation, H. EULER and P. LINDNER (*Chemie der Hefe und der Alkoholischen Gärung. Leipsic: Akad. Verlags Gesell., 1915, pp. X+350, pls. 2, figs. 17*).—In this treatise on yeast and alcoholic fermentation some of the subjects considered are the morphology and classification of yeast, the chemistry of the cell contents, the enzyms of yeast, the chemical processes of fermentation, the metabolism of the yeast cell, the influence of end products on the living cells, toxins, and adaptability and regeneration. The volume contains many illustrations and a complete author and subject index.

A study of the soft resins in sulphured and unsulphured hops in cold and in open storage, G. A. RUSSELL (*Letters on Brewing, 15 (1915), No. 1, pp. 8–23, figs. 10*).—Previously noted from another source (E. S. R., 33, p. 709).

Bákhar.—The Indian rice beer ferment, C. M. HUTCHINSON and C. S. RAM AYYAR (*Mem. Dept. Agr. India, Bact. Ser., 1 (1915), No. 6, pp. 168, pls. 2*).—Bákhar is an artificial culture containing living fungi or their spores, together with yeast. The former saccharify the rice starch and the latter ferment the sugars thus produced. No uniformity in the number or kinds of molds and yeast was shown by the analysis of samples of bákha from various localities. The saccharifying power of different samples was determined and found to vary greatly. The native method of preparation of the cake was investigated, and the results are reported in detail.

On oxidase enzyms, A. J. EWART (*Rpt. Brit. Assoc. Adv. Sci., 84 (1914), pp. 577, 578*)—The close correspondence between enzyms and inorganic oxidizers is discussed. The author states that there is no justification for the use of such terms as peroxidase, catalase, enoxidase, and tyrosinase to indicate specific substances, ferments, or groups of ferments. Chloroform strongly, and ether less so, retard or inhibit catalase action, but do not suppress oxidase action except after prolonged contact. Contrary to previous statements, oxidase enzyms are present in the pulp and rind of the orange and lemon and in the stalks, but not in the bodies of the endocarpal hairs. They are also abundant in the phloem, and outer cortex but not in the protoxylem of the carrot. The oxidases of the beet and potato appear to be related and to be among the strongest occurring in plants.

A study of the composition and preparation of Bordeaux mixture, L. SICARD (*Ann. École Nat. Agr. Montpellier, n. ser., 14 (1915), No. 3, pp. 212–253*).—From a series of experiments on Bordeaux mixture the author has found that when pure milk of lime is slowly added with stirring to a solution containing 1 kg. of copper sulphate, the mixture obtained is acid until 168.5 gm. of lime have been added. All the copper is then insoluble and the liquid is neutral without an excess of lime. With quantities of calcium oxid between 168.5 and 225 gm. the mixture is still neutral, the alkalinity after each addition slowly disappearing, but after the addition of 225 gm. the mixture is distinctly alkaline.

The reaction between the lime and the copper sulphate is deemed a rather complex one. The author claims that a basic copper sulphate, a double hydrate of copper and calcium, a double sulphate of copper and calcium, and a tetra-, a penta-, and a deca-copper sulphate are formed, the formation of the latter being dependent on the quantity of lime used. The tetra-copper sulphate is the active fungicide. The quantity of lime necessary to precipitate the copper was found to be less than that recommended by most investigators.

See also a previous note (E. S. R., 33, p. 449).

Technical methods of chemical analysis, edited by G. LUNGE ET AL., trans. and edited by C. A. KEANE ET AL. (*London: Gurney & Jackson, 1914, vol. 3, pts.*

1, pp. XXXI+538, figs. 63; 2, pp. XVI+539–1125, figs. 35).—This is volume 3, parts 1 and 2, of the work previously noted (E. S. R., 27, p. 609). Among the subjects considered are mineral oils; lubricants; oils, fats, and waxes; special methods of analysis employed in the oil and fat industries; resins, balsams, and gum resins; drugs and Galenical preparations; essential oils; tartaric acid; citric acid; organic preparations; India rubber and rubber goods; vegetable tanning materials; leather; ink; sugar; starch and dextrin; alcohol, potable spirits, and liqueurs; vinegar; wine; brewing materials and beer; paper; textile fibers; and inorganic colors.

The application of the paper pulp filter to the quantitative estimation of calcium and magnesium, S. L. Jodidi and E. H. Kellogg (*Jour. Franklin Inst., 181 (1916), No. 2, pp. 217–232, fig. 1*).—From their investigations the authors conclude that the use of the paper pulp filter is superior to ordinary paper filtration, both in point of time and ease of manipulation. Experimental data indicate that as great accuracy is possible with the pulp filter as with standard filter paper.

Differential iodimetry.—I, Determination of periodates, iodates, bromates, and chlorates in the presence of each other, O. L. Barnebey (*Jour. Amer. Chem. Soc., 38 (1916), No. 2, pp. 330–341, figs. 2*).—As a result of his studies the author has found that "(1) certain oxidizing agents can be determined in the presence of each other iodimetrically in a differential manner by regulation of the concentration of reagents, especially the acidity, the temperature, and the time of reaction. (2) Periodate reacts completely with iodid in saturated boric acid solution containing sufficient borax to diminish the acidity to a slight extent, forming iodate and free iodin. (3) Iodate is acted on by tenth-normal iodid in fourth-normal acetic acid solution and the free iodin can be titrated. (4) In fifth-normal hydrochloric acid solution containing tenth-normal iodid, bromate is completely decomposed and the free iodin can be titrated. (5) Sixth-normal hydrochloric acid acting in presence of tenth- to fifth-normal iodid decomposes chlorate completely. After rendering the solution alkaline and then acidifying, the iodin can be titrated with thiosulphate. (6) By combination of (2), (3), (4), and (5), periodate, iodate, bromate, and chlorate can be determined differentially in the presence of each other and in the presence of perchlorate."

A simple hydrogen electrode, H. P. Barendrecht (*Biochem. Jour., 9 (1915), No. 1, pp. 66–70, figs. 2*).—The author describes a simple arrangement for the determination of the true reaction of liquids as an improvement on the electrometric titrating apparatus described by Walpole.[a] Instantaneous and accurate estimations can be made in liquids which contain carbonic acid and oxygen.

A method for the estimation of hygroscopic moisture in soils, W. D. Haigh (*Sci. Proc. Roy. Dublin Soc., n. ser., 14 (1915), No. 40, pp. 529–534, fig. 1*).—A method for determining the hygroscopic moisture in soils is described, which is based on the desiccating effect of calcium carbid. An apparatus is used in which the soil and an excess of calcium carbid are mixed, and the acetylene gas evolved, as a result of the calcium carbid taking up the soil moisture, serves as a measure of the hygroscopic water in the soil.

Comparative tests of this method with the ordinary method of heating in the water oven, using six arable soils and a sand and a peat soil, showed that while the results obtained by both methods agreed quite closely, the amount of water indicated by the carbid method was always slightly lower than that indicated by heating in the oven. The difference increased in a rough proportion to the

[a] Biochem. Jour., 7 (1913), No. 4, pp. 410–428.

hygroscopic moisture present. "The increased hygroscopic moisture present was due almost entirely to an increase in organic material or humus. In the case of a pure peat the difference is as much as 1.5 per cent, while in a sand with no organic matter the results agree. It would appear from this that when a soil contains much organic material the loss of weight on heating to 100° C. represents more than the hygroscopic moisture present in the soil, part of the loss being made up of other volatile constituents which are driven off on heating."

On the basis of these results the carbid method is considered to be a rapid and reliable means for estimating the hygroscopicity of soils.

A note on the Hopkins-Cole reaction for protein, H. G. D. BREIDAHL (*Biochem. Jour., 9 (1915), No. 1, pp. 36, 37*).—Of the materials tried in an effort to reduce the amount of oxidizing agents in fresh sulphuric acid and consequently to give the best color in the ring produced, granulated zinc was found to be the most practical for large quantities of acid.

Modified Wohlgemuth method for the determination of amylase activity in the presence of alkaloids, J. BODNÁR (*Kisérlet. Közlem., 18 (1915), No. 2, pp. 367–372*).—The original procedure (E. S. R., 20, p. 208) has been modified in that the alkaloids which had been found to interfere with the color changes are removed by extraction, after the reaction is complete, with a suitable organic solvent. The alkali is then neutralized with hydrochloric acid and the determination completed in the usual manner.

Bacteriological methods in food and drugs laboratories with an introduction to micro-analytical methods, A. SCHNEIDER (*Philadelphia: P. Blakiston's Son & Co., 1915, pp. VIII+288, pls. 6, figs. 87*).—As stated in the preface, the volume is primarily intended as a guide to students who are interested in the bacteriological examination of foods and drugs. Practical laboratory methods for food examination are outlined and discussed.

Investigations in regard to the determination of the starch content of potatoes, H. J. F. DE VRIES (*Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefstat. [Netherlands], No. 18 (1915), pp. 1–82, pls. 3*).—As indicated by experimental data the specific gravity is not a reliable index to the starch content of potato flours, a chemical analysis being the only means of determining the true starch content. In manufacturing establishments where no laboratory is available and the specific gravity method must be resorted to, the author recommends the use of new tables for the determination of the starch content from the specific gravity, and he prefers the Reinmann or Parow balance to the Stohman method.

The most accurate value for the starch content of a potato flour is found by an indirect analysis, as follows: 100— (moisture at 120° C.+ash+soil material+ether extract+protein+pentosans). Lower values, however, for the starch content are obtained on the average by the Baumert-Bode and Ewers methods than by indirect analysis, as on dissolving the starch according to Baumert and Bode and Ewers, products which reduce Fehling's solution are formed. The method of Ewers is recommended.

Chemical testing of milk and cream, R. H. SHAW (*U. S. Dept. Agr., Bur. Anim. Indus. Doc. A-7 (1916), pp. 38, figs. 31*).—This bulletin contains detailed descriptions of methods for the determination of fat, total solids, specific gravity, acidity of milk and cream, calculation of total solids by formula, and the detection of preservatives. A list of chemicals and apparatus used in the chemical analysis of milk and cream is appended. The subject matter is treated in such a manner that it may be followed by those who have had neither chemical training nor a course in milk testing.

Determination of the quantity of fat in cream, L. LINDET (*Compt. Rend. Acad. Agr. France, 1 (1915), No. 11, 340–346; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 8, p. 1113, 1114*).—After pointing out the difficulties incident to present methods of determining the quantity of fat in cream, the author describes a method which consists in placing a drop of cream on a piece of foolscap paper, which is then kept at a temperature of 105° C. for two hours. The area of the spot that is thus produced is measured and compared with standards which have been previously prepared with butter fat and treated in an identical manner. A comparison of the method with the desiccation and ether extraction methods indicated a close agreement in analytical results.

The colorimetric determination of acetylene, E. R. WEAVER (*Jour. Amer. Chem. Soc., 38 (1916), No. 2, pp. 352–361, figs. 2*).—In the course of an investigation upon the determination of small amounts of water by the use of calcium carbid the author has devised a colorimetric method for the detection of small amounts of acetylene.

The gas to be investigated is passed into an ammoniacal solution of cuprous chlorid, containing gelatin and alcohol, and the resulting red colloidal solution compared with a suitable standard, such as a solution of a red dye or a piece of ruby glass. The method is deemed very sensitive, it being possible to detect amounts as small as 0.03 mg. of acetylene. Hydrogen sulphid and large amounts of carbon dioxid and oxygen interfere with the determination, but these may be removed, without loss of acetylene, by passing the gas to be tested through a hot alkaline solution of pyrogallol. Several applications of the method are described.

The results as to the determination of water were not satisfactory.

Report of the bacteriologist, W. GILTNER (*Michigan Sta. Rpt. 1915, pp. 208, 209*).—Analyses of a vinegar prepared from maple sap skimmings and of the brine from a normal fermentation of brine pickles are reported. It is concluded that "a vinegar with very good flavor and quality may be produced from maple skimmings or from maple sap at reasonable cost."

Preliminary bulletin on canning, A. W. BITTING (*Nat. Canners Assoc. Bul. 4 (1915), pp. 65*).—This is preliminary to a publication which will give a more complete treatment of the subject of canned foods. The minimum requirements necessary for successful results in the canning of various fruits and vegetables are outlined. Analytical and other data obtained in canning experiments are submitted.

Experimental work on soda cellulose, S. D. WELLS (*Paper, 17 (1915), No. 4, pp. 14, 15, fig. 1*).

METEOROLOGY.

Problems and results of agricultural meteorology, V. K. GAUER (*Trudy Selsk. Khoz. Met., No. 14 (1915), pp. 81–119*).—The more important contributions to this subject are reviewed in this article.

Meterological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and D. POTTER (*Massachusetts Sta. Met. Buls. 325, 326 (1916), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during January and February, 1916, are presented. The data are briefly discussed in general notes on the weather of each month.

[Meterological observations], D. A. SEELEY (*Ann. Rpt. Sec. Bd. Agr. Mich., 54 (1915), pp. 175–186*).—Daily and monthly summaries of temperature (maximum, minimum, and mean), precipitation, cloudiness, and sunshine, and

monthly summaries of pressure (maximum, minimum, and mean), wind movement, and miscellaneous phenomena (frost, hail, thunderstorms, fog, auroras, and halos) at East Lansing, Mich., are given for the year ended June 30, 1915.

Climatology [of Quebec], J. L. DECARIE (*Statis. Year Book, Quebec, 1915, pp. 118–128, figs. 3*).—The temperature and precipitation during 1914 and preceding years are shown in tables and diagrams and the general characteristics of the climate of the Province are briefly described.

It is shown that climatologically the Province may be divided into three sections; the first, extending from Gaspé to Rimouski, which is very damp on account of proximity to the Atlantic Ocean, with a temperature varying from −30 to 80° F. and a crop season from May 30 to October 15; the second, lying between Rimouski and Three Rivers, with a temperature varying from −30 to 90° F. and a crop season from May 15 to November 1; and the third, covering the territory from Three Rivers westward to the boundaries of the Province, with a temperature varying from −27 to 93° F. and a crop season from April 20 to November 20.

The climate is, on the whole, continental and winter passes rapidly into summer and vice versa. "Life awakens with an outburst of vegetation in the forest after a long winter and almost as abruptly, after a short but delightful autumn, plants begin their slumber. The entire cycle for the flora is accomplished in from five to seven months, from May to the first fortnight of November. When snow falls at the beginning of December it does not melt and it hardens gradually. By means of such a protective covering plants are sheltered from the frost which threatens them in a less severe climate; snow shelters even houses from cold. [It also] keeps the ground warm in winter and fertilizes it." The climatic conditions, in spite of their severity, are stated to be favorable to the growth of cereals, forage plants, roots, or fruits, and for stock raising.

Temperature inversions in relation to frost, A. MCADIE (*Ann. Astron. Observ. Harvard Col., 73 (1915), pt. 2, pp. 168–177, pls. 4; Sci. Amer. Sup., 81 (1916), No. 2095, pp. 140–142, figs. 3*).—This article in large measure covers the same ground as that of a paper previously noted (E. S. R., 34, p. 319). Special emphasis is laid upon the importance of the mixing of air and the relation of air drainage to frost formation.

Influence of the principal meteorogical factors on winter rye, R. G. ZALENSKIĬ (*Trudy Selsk. Khoz. Met., No. 14 (1915), pp. 48–63, figs. 6*).—The results of seven years' observations at the Bogoroditsky Agricultural College on the influence of precipitation and temperature on the growth and yield of winter rye are summarized. The general conclusion is that the best distribution of spring and summer precipitation and of temperature is as follows: Abundant precipitation and heat before the formation of heads; cool and damp weather during the formation of heads; dry and moderate temperature during the time of blooming; and moist and warm weather during the ripening period.

Physical conditions in sphagnum bogs, G. B. RIGG (*Bot. Gaz., 61 (1916), No. 2, pp. 159–163*).—From an analysis of data reported by Cox in a bulletin of the Weather Bureau dealing with frost and temperature conditions in the cranberry bogs of Wisconsin (E. S. R., 26, p. 514), the author concludes that the temperature conditions in both soil and air are less favorable for plants in bogs than on neighboring firm land, and still less favorable in sphagnum moss than in bare peat. As far as relative humidity is concerned, the conditions are less favorable for transpiration on a bog than on neighboring firm land.

Smoke as a source of atmospheric pollution, W. F. M. GOSS (*Jour. Franklin Inst., 181 (1916), No. 3, pp. 305–338, figs. 5*).—This article summarizes the more

The soils of the county are divided into upland soils of glacial and loessial origin, alluvial terrace soils, and first bottom soils derived from recent stream deposits. Twelve soil types of eight series are mapped, of which the Carrington, Marshall, and Wabash silt loams cover 42.3, 24, and 19.7 per cent of the area, respectively. The soils of the county are dark in color and rather high in organic matter content.

Soil survey of Oneida County, New York, E. T. MAXON, M. E. CARR, and E. H. STEVENS (*New York Cornell Sta. Bul. 362 (1915), pp. 59, pls. 2, figs. 2*).—This survey has been noted from the Field Operations of the Bureau of Soils of this Department for 1913 (E. S. R., 34, p. 123).

The soils and agricultural development of the Mohawk Valley, E. O. FIPPIN (*Cornell Countryman, 13 (1915), No. 3, pp. 203–206, figs. 2*).—This article briefly discusses the general characteristics of the soils of an area in New York which occurs as a deep, broad trough between the Catskill and Adirondack Mountains. The soils are of igneous, limestone, and shale origin and are said to vary widely in productivity.

Analyses of soils of different localities in the Belgian Congo, M. G. BATZ (*Bull. Agr. Congo Belge, 5 (1914), No. 4, pp. 601–629*).—Physical and chemical analyses of 36 samples of soil from seven different districts of the Belgian Congo are reported and briefly discussed.

Experiments at Oxford on the analysis of Belgian Congo soils, E. LEPLAE (*Bul. Agr. Congo Belge, 5 (1914), No. 4, pp. 630–654, figs. 15*).—Nine series of pot culture experiments with Belgian Congo soils, which were so arranged as to indicate the nutritive constituents relatively in minimum in the soils, showed that these soils are lacking in nitrogen and available phosphoric acid. These results are compared with chemical analyses of the same soils, showing the defects in ordinary methods of chemical soil analysis for indicating the fertilizer needs of these soils. Further studies to perfect methods of chemical analysis are in progress.

A study of nitrification in Philippine soils, E. H. PAÑGANIBAN (*Philippine Agr. and Forester, 4 (1915), No. 4, pp. 81–91*).—Nitrification experiments, using ammonium sulphate and dried blood, on yautia, corn, banana, and cogon soils and on a nursery soil, and experiments with the same soils on the influence on nitrification of calcium carbonate, magnesium carbonate, and sand, and of varying the soil moisture content are reported.

Different soils, although similar chemically, showed different rates of nitrification. A part of this difference is attributed to the influence of the present and preceding crops on the bacterial flora of the soil. Some soils originally in cogon grass that had grown crops continuously for three years gave a low rate of nitrification amounting to from 5.55 to 7.84 mg. in a 100-gm. sample of soil during four weeks' incubation at room temperature, in the presence of 16.34 mg. of nitrogen as dried blood. Two plats tested that had been but recently brought under cultivation gave a much more rapid rate of nitrification, amounting to from 8.27 to 14.71 mg. under the same conditions. The nitrification with ammonium sulphate was about 50 per cent more rapid than that with dried blood. Lime applied at the rate of 15 tons per hectare (about 6 tons per acre) increased the rate of nitrification by more than half, while rapid evaporation during the time of incubation lowered the rate a great deal, and the addition of 25 per cent sand to clay soil increased it as much as 80 per cent. By sterilizing the soil with heat, nitrification was almost entirely suppressed, even though the soil was afterwards reinoculated. Magnesium carbonate interfered with nitrate formation to as much as 40 per cent and caused nitrites to accumulate in the soil.

These results are taken to indicate that the soils should be limed, but that the calcium carbonate should contain as little magnesium carbonate as possible. Dried blood is considered preferable to ammonium salts as a fertilizer. It is recommended that optimum moisture conditions (20 to 40 per cent moisture) be maintained in the soil, that surface cultivation be frequent, and that cogon lands be not burned off.

Nitrogen content of the humus of arid soils, F. J. ALWAY and E. S. BISHOP (*U. S. Dept. Agr., Jour. Agr. Research, 5 (1916), No. 20, pp. 909–916*).—In this contribution from the Minnesota Experiment Station, the work of others bearing on the subject is briefly reviewed, methods of humus nitrogen determination in soils are discussed, and the results of determinations of humus and humus nitrogen in 16 virgin and cultivated arid California soils, made by the authors in 1911 while at the Nebraska Station, are reported.

"Of the 16 samples only five show as high as 10 per cent of nitrogen in the humus. For the 6 samples of virgin soil the average is 8.5 per cent, with a maximum of 12 and a minimum of 4 per cent. For the 10 of cultivated soils the corresponding data are 8.1, 11.8, and 5.6 per cent, respectively. The maximum possible percentages of nitrogen in the humus—the relation of the total nitrogen to the humus—ranged from 5.5 to 19.6 per cent, with an average of 13.1." These results are taken to "confirm the work of Hilgard that high percentages are to be found in the arid, but not in the humid soils. This high nitrogen content of the humus, however, does not appear so general in the arid soils as to serve as an at all reliable means of identification."

Investigations on ammonia adsorption by soil, L. PINNER (*Kühn Arch., 6 (1915), pt. I, pp. 153–238, figs. 5; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 10, pp. 1304, 1305*).—The history and theory of the adsorption of gases by soils and other materials are reviewed in some detail, and experiments with a number of German soils and with red soils from other countries are reported. The purpose was to determine the adsorptive power of the soils for ammonia when treated with ammonia solution, gaseous ammonia, and ammonium chlorid solution. The ammonia adsorption was determined gravimetrically and volumetrically. Parallel experiments were conducted with charcoal and permutite.

It was found that no conclusive parallelism existed between ammonia adsorption and the mechanical and chemical properties of the soils. The ammonia adsorption values for the native soils were parallel to their hygroscopicity values. The red soils showed a wider and more irregular relation between hygroscopicity and adsorption of gaseous ammonia. Ammonia adsorption by soils was similar to that by charcoal. The greatest gas adsorption occurred within a few minutes and became constant only after some hours. Ammonia adsorption was greater by soils retaining some hygroscopic moisture than by dried soils, but not as great as by dried soils and water together. Part of the adsorbed ammonia gas was retained by the soils even when aerated for some weeks. While certain relations existed between the adsorption of ammonia from ammonia solution or ammonium chlorid solution and the adsorption of gaseous ammonia, no parallelism was proved. Ammonia adsorption by soil from ammonium chlorid and from ammonia solution also differed. An increase in the quantity of ammonium salt solution used caused a decrease in ammonia adsorption by all the soils.

It is concluded that ammonia adsorption varies considerably on account of the complex nature of the soil, thus practically preventing the formation of a theory applicable to all kinds of soils. However, the Freundlich theory that adsorption is a surface condensation process is considered the most probable.

The alkaline reaction produced in soils by acids in relation to plant nutrition.—I, Solubility of iron compounds in the soil, G. MASONI (*Staz. Sper. Agr. Ital., 47 (1914), No. 9–10, pp. 674–701; abs. in Chem. Zentbl., 1915, I, No. 10, p. 498; Chem. Abs., 9 (1915), No. 13, p. 1816*).—Experiments based in part on results noted in a previous study (E. S. R., 30, p. 122) are reported. The dissolving power of hydrochloric, nitric, sulphuric, phosphoric, formic, acetic, oxalic, succinic, malic, tartaric, and citric acids and of potassium sulphate, monopotassium phosphate, monopotassium oxalate, monosodium tartrate, and monopotassium citrate, when used in twentieth-normal, fiftieth-normal, and in normal solutions were observed on the iron compounds in a calcareous soil, with and without additions of ferric and ferrous salts and with and without the presence of carbon dioxid. The processes involved both direct mixing and percolation.

The dilute solutions of all the acids, excepting citric, tartaric, and malic acids, failed to throw iron into solution from the soil alone, and even when ferrous and ferric salts had been added. Dilute citric acid dissolved considerable iron under all conditions and tartaric and malic acids relatively less, as did also the solutions of their corresponding salts. The reaction was, however, always for ferrous iron. The presence of relatively large quantities of carbon dioxid did not modify the results. Similar experiments made with pure calcium carbonate yielded similar results.

The normal solutions of the acids and acid salts in practically every case dissolved iron in a more or less marked degree.

The results of these experiments are considered to throw more or less light on the cause of chlorosis in plants growing in limestone soils, in that the weak acids from plant roots act in the same manner as the weak acids noted above. This results in the iron compounds being precipitated in insoluble form.

Soil moisture investigations (*Washington Sta. Bul. 127 (1915), pp. 15–20, figs. 3*).—The results of three seasons' investigations on the water requirements of seven of the more important crops are given in the following table. "Moisture determinations were made to a depth of 10 ft. at time of planting and at harvest on both cropped and check plats. . . . The difference between the cropped and check plats is what was taken by the crops."

Yield and water requirements of crops.

Crop.	Yield, average 3 years.		Ratio of grain to straw.	Water loss.			
	Grain.	Straw.		Transpiration.	Evaporation.	Rainfall.	Total.
	Bushels.	*Tons.*		*Acre-inches.*	*Acre-inches.*	*Acre-inches.*	*Acre-inches.*
Wheat	44.2	1.86	1:1.45	12.75	3.36	3.30	19.41
Oats	85.0	1.72	1:1.27	9.95	2.47	3.30	15.72
Barley	48.4	1.64	1:1.50	8.80	2.00	3.30	14.10
Corn	33.4	1.88	1:1.61	3.72	2.36	3.15	9.23
Peas	31.5	1.27	1:1.34	7.33	1.82	3.30	12.45
Beans	9.7	.51	1:1.75	3.47	2.57	3.15	9.19
Millet	.....	2.75	.....	6.54	1.92	2.45	10.91

In an attempt to ascertain whether there is any variation in the distribution of nitrates at relatively small distances in soil, a cubic yard of soil so laid off that a sample was taken every 4 in. parallel to the faces of the cube, making in all 1,000 samples. Analyses of these for nitrate content showed that "the samples containing more than 10 parts of nitrates per million of dry soil

constituted 1.1 per cent of the total number of samples taken and their total nitrate content was approximately 10 per cent of the total nitrate as contained in all samples."

Studies on the influence of cultivation on nitrate development in 11 tenth-acre plats of silt loam soil showed that the highest nitrate content was found in early spring. Two months later there was only a small amount left, but it was in the same proportion as in April and at harvest time there was still less. In November, two and one-half months after harvest there was a slight increase but not until the fall rains came was there a very material development. The following spring there was a marked increase in those plats which were fall plowed.

Duty of water experiments at the Grandview substation on corn and potatoes during a season with a rainfall of 7.35 in. gave results showing that the yield of corn per acre was greatest with an 8-in. application of water, followed in order by 4, 12, 20, and 16 in. applications. The yield per acre-inch of water applied, however, decreased steadily as the size of application increased. The yield of potatoes per acre increased as the application increased from 4 to 21 in., while the yield per acre-inch decreased as the application increased.

A study of the percolation of water in coarse sand, medium sandy loam, and fine sandy loam showed that the absorptive power of the soil gradually decreases "as the time increases with the application of water."

The water-supplying power of the soil as indicated by osmometers, H. E. PULLING and B. E. LIVINGSTON (*Carnegie Inst. Washington Pub. 204 (1915), pp. 49–84, figs. 2*).—Preliminary experiments on the power of an artificial soil mixture, consisting of 3 parts of sand and 1 part of dry loam, to supply water to the roots of plants, as indicated by osmometers prepared from ordinary thistle tubes with the large opening closed by a collodion membrane, are reported. Cane sugar solution was used in these osmotic cells. The osmometers were tested both in water and in the soil mixture. The collodion membranes were found to be suitable for the making of osmotic cells for such experiments.

Packing of the soil was found to be of prime importance in determining its water-supplying power. "The lack of suitable methods for obtaining strictly comparable packing of a number of soil samples is one of the main obstacles to a rapid investigation of the field thus opened."

In this connection it is also considered evident that "it is the percentage of contained soil moisture on the basis of actual soil volume, and not this percentage calculated on dry weight of the soil, which plays an important part in determining the efficiency of the soil as a source of water supply to growing plants. . . . The influence of temperature upon the water-supplying power of the soil, or at least upon its measurement, appears to be of great importance."

It was further found that the osmotic solution used (5-weight molecular cane sugar) was too concentrated to permit the measurement of the water-supplying power of the soil mixtures with the water content much above their critical optimum. Below the critical moisture content the tests gave quite satisfactory results. "Of fundamental interest is the fact that the critical point in soil-moisture content appears to be approximately the same as that emphasized as the critical optimum water content by workers in other lines of soil physics."

The freezing point method as a new means of measuring the concentration of the soil solution directly in the soil, G. J. BOUYOUCOS and M. M. MCCOOL (*Michigan Sta. Tech Bul. 24 (1915), pp. 44, figs. 2*).—This bulletin reports the details of experiments previously noted (E. S. R., 34, p. 419). In addition to the results noted in the previous report it was found that, at the low moisture

content, the lowering of the freezing point of soils is very high and varies considerably with the extreme types of soil, being highest in clay and lowest in sand.

"In all the soils, with the exception of quartz sand and some extreme types of sandy soil, the ratio of the lowering of the freezing point is not directly inversely proportional to the ratio of the water content . . . but the former is many times greater than the latter. . . . By determining the lowering of the freezing point of various soils at a large number of moisture contents it was found that . . . the lowering of the freezing point increases in a geometric progression while the water content decreases in an arithmetic progression. In the case of quartz sand and some extreme types of sandy soil, however, the depression of the freezing point increases inversely proportional with the water content. . . . All evidences, both direct and indirect, point to the fact that high depressions of the freezing point are produced by and represent actual concentration. . . . The rate of increase in the lowering of the freezing point with the decrease in moisture content is uniform throughout, from the maximum to the minimum moisture content, etc."

Further experiments with washed quartz sand, silt loam, clay, sandy loam, humus loam, peat, and kaolin to determine, by means of the freezing point method, the influence of adding tenth-normal solutions of potassium chlorid, potassium sulphate, magnesium sulphate, ammonium sulphate, calcium nitrate, sodium nitrate, potassium phosphate, calcium phosphate, and sodium phosphate to the soils, showed that "in the case of the neutral salts the concentration of the soil solution was increased from 20 to 100 per cent of their strength employed, while in the case of the soluble phosphates the concentration of the soil solution of all the soils except peat, quartz sand, and kaolin, was extremely little, if any, increased. These results on the whole do not confirm entirely the theories that the application of soluble salts, even in small amounts, may not increase the total concentration of the soil solution."

Changes in soils brought about by heating, A. WILSON (*Sci. Proc. Roy. Dublin Soc., n. ser., 14 (1915), No. 38, pp. 513–520, figs. 3*).—Laboratory experiments are reported in which the depression of freezing points and the electrical conductivities of extracts of soils which had been heated for two hours at from 60 to 150° C. were determined.

It was found that heating increased the amount of soluble matter in soil, this being indicated by a considerable increase in electrical conductivity, a marked depression of the freezing point, and a wide range of coloration of extracts from soil heated at different temperatures. "In each of the extracts about half the depression of freezing point was due to electrolytes. The increase in the amount of water absorbed by the heated soil indicates a change in the texture of the soil brought about by heating. . . .

"The results of these experiments show that at any rate part of the increased productivity of heated soil may be due to the increase in soluble matter induced by heating, and to the change in soil texture, which has a remarkable effect on the retention of water by the soil."

A list of references to literature bearing on the subject is appended.

Soil fertility, J. E. RUSH (*Science, n. ser., 42 (1915), No. 1088, pp. 632–634*).—It is stated that "the problem of soil fertility is a composite one which needs for its solution a knowledge of the interrelated subjects physics, chemistry, and bacteriology." The presence of the proper bacteria in the soil is, however, considered to be the final deciding factor in soil fertility.

Maintaining fertility in the Wisconsin drift soil area in Iowa, W. H. STEVENSON, P. E. BROWN, and L. W. FORMAN (*Iowa Sta. Bul. 161 (1915), pp.*

235–263, figs. 5).—Five series of experiments with corn, oats, and clover on 46 tenth-acre plats and 12 three-twentieth-acre plats of loam soil, to determine the fertility needs of this soil and the influence of rotation and the uses of phosphorus, potassium, manure, and catch crops, are reported. Each series of plats received the following soil treatment: Legume; manure; manure and legume; manure, legume, and phosphorus; legume and phosphorus; manure and phosphorus; legume, phosphorus, and potassium; manure, phosphorus, and potassium; phosphorus and potassium; and phosphorus.

It was found absolutely essential that a definite rotation of crops be followed which contained a legume to be turned under as a green manure or fed to live stock and the manure returned to the land. "Comparison of the yields of corn grown continuously on the same soil for eight years with those secured in the four-year rotation show much greater yields in the latter case. . . .

"The supply of organic matter and nitrogen must be kept up in this soil and the cheapest and best method of accomplishing this is by the use of farm manure. Applications of manure have been shown to bring about considerable increases in crop production, and greater net returns have been secured by its use than with any other fertilizing constituents and in most cases greater yields were obtained. . . .

"Where manure is not produced the organic matter and nitrogen content of the soil must be maintained by the use of leguminous crops, as green manures. When green manuring is practiced care should be taken that no injury to the main crop occurs. Experiments with cowpeas turned under as a catch crop in the corn frequently showed a depression in the yields of corn. . . . Soil and climatic conditions and the particular seasonal conditions must determine the safe use of legumes. Other legumes, like red clover, may be grown as a regular crop in the rotation and only the seed removed, the remainder of the crop being turned under in the fall. . . .

"Phosphorus and potassium . . . at the present time do not appear to be limiting factors in crop production on the Carrington loam. Applications of these materials did not prove profitable on any of the crops grown in the regular rotation, although in some cases small increases in yields were secured. There is an indication that a small amount of a soluble potassium fertilizer might prove of value for clover."

Drainage, cultivation, and liming are also emphasized as important factors in maintaining the fertility of Wisconsin drift soils.

The fertility in Iowa soils, P. E. Brown (*Iowa Sta. Bul. 150, popular ed. (1914), pp. 5–47, fig. 1*).—A popular edition of Bulletin 150 (E. S. R., 32, p. 211).

Rotation, fertilizer, and manure experiments, V. M. Shoesmith (*Michigan Sta. Rpt. 1915, pp. 229–231*).—The data secured up to date in these experiments with wheat, corn, clover, potatoes, beans, rye, oats, and beets are given in tabular form.

In a corn, wheat, and clover rotation it was found that "the increase in yield from the use of the complete fertilizer and from the phosphorus and potassium fertilizer are about the same, but the net value of the increase is somewhat higher in the case of the latter fertilizer. The net value of the increase is larger from the use of the phosphorus fertilizer than when both nitrogen and phosphorus are used. . . . The yard manure when applied at the rate of 5 tons per acre is shown to be worth $2.77 per ton, while stall manure is worth $3.66 per ton when applied at the rate of 5 tons per acre and $3.17 per ton when applied at the rate of 10 tons per acre. When 200 lbs. of acid phosphate have been applied to the 5 tons of manure a sufficient increase has been secured to pay for the acid phosphate and allow $6.46 per ton for the manure, or nearly twice the value of the untreated manure."

Peculiar plant physiological action of an ammonium fertilization, H. G. SÖDERBAUM (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 125 (1915), pp. 13, figs. 2*).—Pot experiments with barley on a sand soil are reported, in which superphosphate, Thomas slag, and bone meal were used in different experiments to supply phosphoric acid, while nitrogen was supplied as ammonium chlorid and ammonium sulphate. The experiments were conducted with and without additions of the sulphate or carbonate of magnesium.

Two or three weeks after germination the plants in pots receiving superphosphate or bone meal and an ammonium salt, but no magnesium carbonate, showed evidences of sickness and stunted growth. This was especially marked in the pots receiving superphosphate. This effect was not observed in the pots receiving Thomas slag, and additions of magnesium carbonate apparently removed the condition. After such treatment the affected plants recovered and rapidly reached normal development.

These results are taken to indicate that the bad effect produced on the plants is due less to the production of a physiologically acid reaction in the soil than to a direct toxic action of the ammonium salts. The favorable action of magnesium carbonate is explained on the grounds that the transformation of the ammonia into nitrates is accelerated.

Some observations on the storing of calcium cyanamid, A. H. BURGESS and D. R. EDWARDES-KER (*Jour. Southeast. Agr. Col. Wye, No. 22 (1913), pp. 363–367; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 5, pp. 675, 676*).—From the results of a series of experiments the authors conclude that loss of nitrogen from calcium cyanamid exposed freely to the atmosphere is apparently not caused either by moisture or carbon dioxid or by both acting together. When stored in air-tight containers there is no loss of nitrogen and, therefore, the loss noted when exposed to the air is probably caused by some atmospheric agent. A fall in the percentage of nitrogen, owing to the increase of weight, is caused by the absorption of water, but water does not cause any real loss of nitrogen.

The world's supply of potash (*London: The Imperial Institute, 1915, pp. 47; abs. in Nature [London], 96 (1915), No. 2394, pp. 60, 61*).—This pamphlet contains an account of the more important sources of potash in the world, including the Stassfurt deposits in Germany.

It is stated that besides the Stassfurt deposits, the only extensive deposit of carnallite known is that at Catalonia, in Spain. "All plants contain more or less potash, and the utilization of the ash of wood, the ash of seaweed, of beet-root residues, and similar by-products of industries in which vegetable materials are employed, is of importance, . . . especially at a time of scarcity." The ashes of seaweed, waste wood, hedge trimmings, and vegetable refuse, and the waste water from the wool-scouring process are also discussed as promising sources of potash.

The origin, mining, and preparation of phosphate rock, E. H. SELLARDS (*Trans. Amer. Inst. Mining Engin., 50 (1914), pp. 901–916, figs. 3*).—This is a summary of information on the subject, referring especially to the Florida and Tennessee phosphate deposits.

Tennessee phosphate practice, J. A. BARR (*Trans. Amer. Inst. Mining Engin., 50 (1914), pp. 917–933, figs. 12*).—This article briefly describes the geology and mineralogy of the Tennessee phosphate deposits and the methods employed in prospecting, valuation, mining, and treatment, and in the manufacture of acid phosphate.

Sensitiveness of lupines to calcium, T. PFEIFFER and E. BLANCK (*Mitt. Landw. Inst. Breslau, 7 (1914), No. 2, pp. 201–233; abs. in Zentbl. Agr. Chem., 44 (1915), No. 1, pp. 22–25; Jour. Chem. Soc. [London], 108 (1915), No. 630, I,*

pp. 201, 202).—While ground limestone proved to be less injurious to lupines than precipitated calcium carbonate, its effects were found to vary greatly (the yield being increased by limestone in one case), so that no limiting point is indicated. Calcium sulphate was also injurious to lupines, apparently causing them to take up less phosphorus.

Assimilation of iron by lupines was retarded by both limestone and potassium nitrate. It is considered probable that the injurious effects of calcium are due partly to its influence on iron assimilation.

Shall gypsum be used as a fertilizer? D. MEYER (*Illus. Landw. Ztg., 35 (1915), No. 39, p. 267*).—Experiments with clover, mustard, oats, and potatoes on an acid sandy loam soil and a neutral sand soil poor in humus to determine the indirect fertilizing value of gypsum are briefly reported. The results are taken to indicate that gypsum has no indirect fertilizing value and that it can not be considered of value as a lime fertilizer.

The value of by-products rich in lime as compared with slaked lime and ground limestone, H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr., 28 (1914), No. 3–4, pp. 210–215, fig. 1; abs. in Zentbl. Agr. Chem., 44 (1915), No. 4–5, pp. 160, 161*).—Pot experiments with red clover on an undecomposed upland moor soil, poor in lime and reacting acid to litmus, to determine the relative values of so-called basic Martin slag containing 37.52 per cent lime, a coal ash from the iron industry containing 18 per cent lime, slaked lime, and ground limestone, when added at the rate of 2,000 kg. per hectare (1,780 lbs. per acre), are reported.

As good results were obtained with the ground limestone and the coal ash as with slaked lime. The results with the basic slag were much behind those of the other three fertilizers for the first crop, but equaled them for the second crop.

Limestones of New York, with reference to their agricultural use, R. C. COLLISON and J. F. BARKER (*New York State Sta. Tech. Bul. 47 (1915), pp. 3–38, pls. 9*).—This bulletin deals briefly with the stratigraphic position, general locality, approximate thickness, adaptability to agricultural use, and prominent characteristics of the 49 limestone formations found within the State of New York, describes separately and more in detail the more important formations, and reports the results of analyses of a varying number of each. A limestone map is included showing the area of outcrop of each of the more important formations or groups of formations, and two stratigraphical columns are given showing diagrammatically cross sections of the hard-rock geology for the eastern and western halves of the State. A final section briefly discusses types and origin of limestones.

Limestone and marl deposits of South Carolina, F. H. H. CALHOUN (*South Carolina Sta. Bul. 183 (1915), pp. 31, figs. 7*).—This bulletin deals with the origin and practical agricultural uses of limestone, and reports an investigation of the lime-bearing deposits of South Carolina made with special reference to those suitable for a source of ground limestone and marl for agricultural purposes.

As a result of this investigation it is considered doubtful if, even under the best management, the limestone of the Piedmont and mountain sections of the State can be so marketed as to compete with North Carolina and Tennessee products.

It is stated that of the marl deposits of the State "few are found which would encourage further investigation. The most promising deposits . . . are those along the Santee River between Ferguson and Eutawville and near Creston, and the deposits on the Pee Dee, near Godfreys Ferry, and those in the lower part of Berkeley and Dorchester counties."

[Agricultural lime] (*Off. Bul. Ohio Agr. Com., 6 (1915), No. 1, pp. 111–119*).—A list of brands of agricultural lime licensed for sale in Ohio from January 1 to June 10, 1915, is given, together with guarantied analyses.

The fertilizing action of common salt, with special reference to its supposed power to replace potash salts, H. G. SÖDERBAUM (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 120 (1915), pp. 26, fig. 1; K. Landtbr. Akad. Handl. och Tidskr., 54 (1915), No. 8, pp. 673–695, fig. 1*).—A historical review of the work along this line is given, and further experiments with sodium chlorid, potassium chlorid, and potassium sulphate on sand and moor soil are reported (E. S. R., 26, p. 623).

The results showed that common salt in the presence of sufficient potash usually caused a marked increase in the oats crop, except where the basal fertilizers contained nitrogen as ammonium chlorid. Common salt was not able to act as a substitute for potash, however, and potassium chlorid alone produced as good results as potassium sulphate and common salt together. The action of potassium sulphate alone was less than when combined with common salt. This is considered to be further proof that the beneficial effect of sodium chlorid is due to the chlorin supplied rather than to the sodium.

Action of free sulphur on vegetation, G. BOSINELLI (*Staz. Sper. Agr. Ital., 48 (1915), No. 3, pp. 175–184; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 7, pp. 931, 932; Jour. Soc. Chem. Indus., 34 (1915), No. 20, p. 1064; Chem. Zentbl., 1915, I, No. 21, p. 1137*).—Pot and field experiments begun in 1913 with vetch, oats, mustard, corn, beans, and rape to determine the effect of small additions of free sulphur on the yield are reported.

The results of the pot experiments showed that the yields were increased in all cases where sulphur was added, but the increases were not very considerable and not proportional to the quantity of sulphur used. The greatest increase in yield sometimes corresponded to the smallest dressings of sulphur. Determinations of protein did not reveal any influence of sulphur on the formation of albuminoids.

In field experiments the sulphur gave only a very slight increase in crop yield and a decrease in the case of mustard. No evidence was obtained that sulphur has any effect upon chlorophyll formation. Further experiments showed that sulphur accelerates the transformation of organic nitrogen into ammonia compounds, but only to a very limited extent, and the action soon ceases. The usefulness of sulphur in practical farming is considered doubtful.

The utilization of coffee pulp, etc., as manure for tropical crops, R. D. ANSTEAD (*Trop. Life, 11 (1915), No. 7, pp. 124–126*).—Analyses of the dry matter in fresh coffee pulp showed a content of phosphoric acid 0.81 per cent, potash 2.38 per cent, and nitrogen 2.61 per cent. This pulp dry matter is considered as good for fertilizing purposes as the best Indian cattle manure. It is stated that mixing the pulp with lime and allowing the pulp to leach in the pulp pit both cause a loss of fertilizing constituents. Two methods of composting the pulp are described.

Fertilizer inspection (*Maine Sta. Off. Insp. 74 (1915), pp. 225–284*).—This bulletin contains the results of actual and guarantied analyses of 628 samples of fertilizers and fertilizing materials collected in Maine under the fertilizer-inspection law of that State during 1915. These are taken to indicate that "on the whole the fertilizers of 1915 are fairly well up to the guaranty." Brief suggestions regarding how best to meet the fertilizer situation in the State in 1916 are also given.

Farmers' bulletin on fertilizers (*Bul. [Maine] Dept. Agr., 14 (1915), No. 4, pp. 48*).—This bulletin contains the results of actual analyses made at the

Maine Experiment Station of 511 samples of fertilizers and fertilizing materials offered for sale in Maine during 1915, together with their guarantied analyses.

[Analyses of fertilizers and cotton-seed meal], B. W. KILGORE ET AL. (*Bul. N. C. Dept. Agr., 36 (1915), No. 11, pp. 85*).—This bulletin contains the results of the actual and guarantied analyses and valuations of 1,376 samples of fertilizing materials, collected in North Carolina during the fall months of 1914 and the spring months of 1915, and of 109 samples of cotton-seed meal.

Analyses and valuations of commercial fertilizers (*Off. Bul. Ohio Agr. Com., 6 (1915), No. 2, pp. 14–56*).—Actual analyses made at the Ohio State University of 518 samples of fertilizers and fertilizing materials offered for sale in Ohio during 1914 are reported, together with their guarantied analyses.

[Commercial fertilizers] (*Off. Bul. Ohio Agr. Com., 6 (1915), No. 2, pp. 61–97*).—This section contains a list of brands of fertilizers licensed in Ohio from January 1 to July 1, 1915, statements covering valuations of commercial fertilizers, and the results of actual analyses made by the Ohio State University of 218 samples of fertilizers and fertilizing materials offered for sale in Ohio during 1915.

AGRICULTURAL BOTANY.

Methods in plant histology, C. J. CHAMBERLAIN (*Chicago: Univ. of Chicago Press, 1915, 3. rev. ed., pp. XI+314, figs. 107*).—This book, which is now in its third edition (E. S. R., 13, p. 425) embodies a considerable number of additions and improvements in technique so that the present volume is practically a new work.

[Report on physiological and pathological studies with plants], G. HÖSTERMANN (*Ber. K. Gärt. Lehranst. Dahlem, 1913, pp. 52–77, figs. 5*).—This report mentions studies carried forward on certain diseases of economic plants, on electroculture, etc., and deals more in detail with the development of root systems by plants in relation to given soils. It discusses also some studies on parthenocarpy in tomato and other plants, and plant breeding in relation to withstanding disease and winter cold.

The pollen-presentation mechanism in the Compositæ, J. SMALL (*Ann. Bot. [London], 29 (1915), No. 115, pp. 457–470, figs. 9*).—The author claims that the hypothesis that the appendages of the style branches and the apical and basal appendages of the anthers are expressions of a tendency to economy of pollen, which is limited only by the biological necessity of providing sufficient pollen to insure fertilization, is supported by evidence in the shape of correlative development of these appendages. Tables are given showing the relative frequency of occurrence of the different types of styles and stamens in the various tribes and the lines of development and specialization in the pollen-presentation mechanism. A bibliography is included.

A quantitative examination of the elements of the wood of trees in relation to the supposed function of the cells in the ascent of sap, H. H. DIXON and MISS E. S. MARSHALL (*Sci. Proc. Roy. Dublin Soc., n. ser., 14 (1915), No. 29, pp. 358–368*).—In order to test the conclusions arrived at by Janse (E. S. R., 32, p. 221), the authors have made some measurements on the structure of the conducting tracts of several trees, and the bearing of these on the hypothesis put forward by that author is discussed. The results as shown are claimed to lend no support to the hypothesis of Janse as to the intervention of the living cells in the ascent of sap in stems.

Formation of nodules, W. GILTNER and C. W. BROWN (*Michigan Sta. Rpt. 1915, pp. 206, 207*).—A brief account is given of a study of some of the factors influencing the development of root tubercles on leguminous plants.

It was found that on the roots of beans, peas, clovers, vetches, and others, newly formed nodules were present when the plants were from three to six weeks old. Perennial plants may exhibit nodules at any time when there is renewed activity in the root system. The life of a nodule was found to be influenced by a number of factors. In case of annual plants, when the seed is ripened and the regenerative process completed, the root system ceases to grow and the nodules are slowly destroyed by the nodule-forming bacteria within and the saprophytic organisms without. In the case of perennial and biennial plants, when the root system for any reason is not actively functioning, the root tubercles are broken down in a manner similar to that mentioned above for annuals. It is claimed in general that improper drainage, drought, acidity of the soil, freezing, etc., interfere with the development of root tubercles, while proper aeration, regular and sufficient watering, the presence in the soil of insoluble carbonates, and suitable growing temperatures encourage their formation.

The daily march of transpiration in a desert perennial, EDITH B. SHREVE (*Carnegie Inst. Washington Pub. 194 (1914), pp. 64, pl. 1, figs. 27; abs in Ztschr. Bot., 7 (1915), No. 2, pp. 122, 123*).—This is a study of the behavior of *Parkinsonia microphylla*, which is said to have been selected on account of its ability to overcome the adverse conditions of a large evaporating surface during the entire year and a high death rate of its seedlings during the first two years. The methods and details of the investigation are given as regards transpirational behavior and factors correlated therewith.

It is stated that the actual transpirational behavior of the plant is indicated more accurately by measurements from small branches of trees growing in the open than by those from potted plants, on account of the previous environmental history of the latter. Transpirational behavior is described, this being considered as indicative of physiological regulation.

An interrelation between stomatal behavior and relative transpiration was apparent. A slight drying out of tissues is thought to account for some changes observed to occur in this connection.

Hourly changes in the relative transpiration rate, stomatal opening, water content of leaves and twigs, and leaf temperature indicate interrelations which are held to be governed by the ratio of demand to available supply of water.

The index of foliar transpiring power as an indicator of permanent wilting in plants, A. L. BAKKE (*Bot. Gaz., 60 (1915), No. 4, pp. 314–319, fig. 1*).—The author has extended his previous study (E. S. R., 34, p. 334) by making observations on the index of foliar transpiring power of sunflower when removed from the soil at 8.30 a. m. and allowed to wilt in the laboratory. The results show a steep decline for one hour, a very gentle decline during four hours, and a rather sharp rise for two hours, followed by a final decline.

The very steep initial decline is supposed to represent the prompt increase of incipient drying within the leaves as noted by Livingston and Brown (E. S. R., 27, p. 331). The gentle decline is ascribed to the period within which the continuous water columns of the plant remained intact, the leaves still slowly drawing water from the stem. The rise between the fifth and seventh hour is considered to represent the period of the breaking of the water columns, as the result of which the foliar transpiration increased on account of the removal of the tensile stress and the admission of air, following which no further tensile strength could be developed. After the seventh hour it is supposed that no more water entered the leaves from the stem and the leaves gradually dried out, showing meanwhile the decreased transpiring power which should accompany desiccation.

It appears then that the stage of wilting just previous to the rise referred to represents an approach to the most intense drying possible without rupture of

the water columns of the plant. At any rate, this rupture represents, apparently, a rather definite critical point in the course of water extraction by the plant, probably the same as that about which the concept of permanent wilting has developed. This plant appears to have reached the stage of permanent wilting in about five hours.

A new method of continuous automatic registration of transpiration, R. A. ROBERTSON and S. J. WILKIE (*Trans. and Proc. Bot. Soc. Edinb., 26 (1914–15), pt. 4, p. 432, pl. 1*).—A comparatively simple apparatus is described by means of which the vapor transpired by a plant can be automatically trapped and weighed and a practically continuous record of the weight made on a revolving drum, the interruptions being so infrequent as not to detract materially from the value of the experiment.

The air is drawn through calcium chlorid tubes to the receiver containing the plant, and then out through a chlorid tube suspended from an arm of a delicately poised lever, to the other end of which is attached a tracing pencil recording on the revolving drum the depression of the other end. The chlorid is renewed once a day, the tubing is very flexible, and condensation on the glass cover of the receiver is obviated by the regulation of the rate of aspiration and by keeping the temperature constant.

Satisfactory continuous records extending over 12 to 30 days are said to have been made for herbaceous plants, succulents, and needle-leaved gymnosperms without appreciably damaging the experimental material.

Observations on the osazone method of locating sugars in plant tissues, S. MANGHAM (*Ann. Bot. [London], 29 (1915), No. 115, pp. 369–391, pl. 1*).—The author has extended the studies previously noted (E. S. R., 26, p. 229), and it is stated that additional light has been thrown on the value of the method employed (which is herein presented in greater detail) and on the limits of its application.

Among the results detailed, it is stated that on the whole the presence of osazone may be held to indicate with a fair degree of accuracy the distribution of the reacting sugars before treatment with the reagent. The presence of impurities in the form of various cell contents, particularly colloidal substances, is thought to influence the crystallization of osazone, and may account for some irregularity in its behavior in plant tissues. It is thought advisable, when using Senft's reagent, to reexamine the preparations from time to time over a period of at least four months before attempting to draw conclusions therefrom.

A bibliography is given.

Migration of reserve material to the seed in barley considered as a factor of productivity, E. S. BEAVEN (*Abs. in Rpt. Brit. Assoc. Adv. Sci., 84 (1914), pp. 660, 661*).—This is an abstract of a paper reporting and discussing the work of the author in collaboration with Biffin and Gosset. It gives a summary of the conclusions arrived at from the studies of the last five years, more particularly as to the value for selection purposes of the accurate determination of the relative seed-forming energy as shown by the coefficient of migration of different races of barley.

It is considered to be impracticable, during the initiatory stages of new races, to separate with any high degree of certainty the most productive races from among those originated by artificial crossing by employment of the merely empirical methods hitherto employed.

The distribution of nitrogen in the seeds of Acacia pycnantha, J. M. PETRIE and H. G. CHAPMAN (*Abs. in Rpt. Brit. Assoc. Adv. Sci., 84 (1914), pp. 666, 667*).—In this summary of work by the authors, it is stated that the whole

seeds of *A. pycnantha* which have been dried in air contain 4.5 per cent of nitrogen, while those with the testa removed show 5.5 per cent, this component being present partly as protein and partly as various other organic compounds. Percentages of nitrogen obtainable by different methods are given.

It is stated that with Sorensen's method of titration no fixation of formaldehyde by amino groups occurs. Attempts to isolate amino acids invariably resulted in the discovery of traces thereof. The amount of purin nitrogen present is said to be less than 1 per cent.

The action of radium and radio-activity on germination in the higher plants. H. AGULHON and THÉRÈSE ROBERT (*Ann. Inst. Pasteur, 29 (1915), No. 6, pp. 261–273*).—The authors have made a study of the effects of radio-activity on seeds during the period in which the young plants are living on the reserves contained in the seed.

Peas were used in three series of experiments. In the first, they were exposed to such emanations as could traverse the walls of sealed tubes of thin glass containing radium bromid. In the second, the seeds were germinated in a solution containing radio-active material. In the third, the emanation was permitted to diffuse from the radium directly into the space containing the seeds.

In the first series, the observable action was unfavorable to development. In the second, the slight concentrations employed appeared to be ineffective. In the third, an accelerating effect on early growth was noted, associated with a degree of etiolation. The possibility that ozone production may have been a factor in the last mentioned case is discussed.

Rules and mechanism of inhibition and correlation in the regeneration of Bryophyllum calycinum. J. LOEB (*Bot. Gaz., 60 (1915), No. 4, pp. 249–276, figs. 11*).—The phenomena of inhibition of regeneration have been studied in *B. calycinum*, and it is stated that they follow the rule that if an organ inhibits regeneration or growth in another organ the latter often accelerates and favors regeneration in the former. This is interpreted to mean that the inhibiting organ receives something from the inhibited organ which is necessary for regeneration.

It is pointed out that this view is in harmony with the older assumption that the phenomena of inhibition in regeneration, and of correlation, may be attributed to the flow of material and to the block thereto after mutilation.

The determination of additive effects. W. J. V. OSTERHOUT (*Bot Gaz., 60 (1915), No. 3, pp. 228–234, figs. 4*).—Having pointed out in previous papers (E. S. R., 31, p. 627; 32, p. 223) that in measuring antagonism it is of importance to determine the additive effects of the substances employed, the author gives analyses of typical cases. He concludes that in most cases two solutions which are equally toxic remain so (at least approximately) when both are diluted to the same degree, allowing the additive effect to be easily determined. In exceptional cases where this does not hold a value may be assigned to the additive effect. Similar considerations apply to unequally toxic solutions.

Acid accumulation and destruction in large succulents. E. R. LONG (*Plant World, 18 (1915), No. 10, pp. 261–272, fig. 1*).—In these experiments, the investigations of Richards (E. S. R., 30, p. 429; 32, p. 429) have been extended to include the larger succulent cacti *Echinocactus wislizeni* and *Carnegiea gigantea*.

It was found that the acidity of the sap of these cacti was higher in the early morning than at sunset, probably on account of nocturnal metabolism and of daily high temperature and photolysis. The higher acidity present in the early morning in the outer portions is thought to be related to the concentration of sugar in this region. The comparative protection given to the inner portions, as regards heat and light, is attributed to the lesser diurnal differences

observable there. The movement of sap of low acidity from center to periphery has little effect upon the variations of acidity of these tracts, as compared with the conjoint effects of light and temperature in this respect, as seen in the outer portions.

Why certain plants are acrid, W. R. LAZENBY (*Sci. Mo., 1 (1915), No. 3, pp. 272–277*).—The author reports an examination of a number of species of plants noted for acridity, stating that the taste varies greatly among the plants tested. The acrid principle is not always volatile and was not found to be soluble in ether. Tests show that the acridity of several members of the Arum family is connected with the abundant presence of needle-shaped calcium oxalate crystals.

The absence of the acrid effect in case of some plants, the cells of which are crowded with raphides, is ascribed to the fact that in such cases the crystals are covered or embedded in an insoluble mucilage, which prevents their coming into contact with the tongue.

The study of plant enzyms, particularly with relation to oxidation, A. D. HALL, E. F. ARMSTRONG, ET AL. (*Abs. in Rpt. Brit. Assoc. Adv. Sci., 84 (1914), pp. 108, 109*).—This is a summary of the third report of the committee on this subject (E. S. R., 32, p. 523).

It is stated that in the flowers of certain white-flowered races of *Primula sinensis* which breed true to whiteness the peroxidase has a definite zonal distribution, and that such races, on crossing with colored forms, yield in the F_2 generation a certain number of plants the flowers of which show a similar zonal character. This pattern is referred to a lack of uniformity in distribution of the peroxidase constituent of the color-forming mechanism, not of the chromogen.

Partial success has been achieved in the discovery of agents indicative of the presence of reductases.

The conception that in life interaction takes place between substances in pairs, the one being oxidized and the other reduced, is considered to simplify materially the study of the oxidative changes in plants.

The formation of red pigments from yellow flowers by reduction and subsequent oxidation has been further studied, the experiments having been extended to quercetin, which has been reduced under a variety of conditions. As a rule colorless compounds are formed which become red on exposure to air or the addition of hydrogen peroxid.

A study has been made of the rates at which various carbohydrate solutions decolorize methylene blue in alkaline solution.

A study of the behavior of lipase in relation with water shows that the presence of even a small proportion of the latter greatly favors the action of the former in the reverse direction.

Studies in permeability.—I, The exosmosis of electrolytes as a criterion of antagonistic ion action, W. STILES and I. JÖRGENSEN (*Ann Bot. [London], 29 (1915), No. 115, pp. 349–367, figs. 14*).—The authors have investigated by the methods of physical chemistry the exosmosis of electrolytes from plant tissue, using disks of potato tuber and also living bean plants, as related to the composition of different external solutions.

From the results as given, they conclude that within certain limits the rate of exosmosis is a measure of toxicity. A decrease in this rate on addition of certain ions to solutions containing poisonous ions might be due, it is thought, to the so-called antagonism. It is claimed to have been shown that in some instances the phenomena are more complex than is generally assumed. The authors emphasize the necessity of examining and analyzing each case separately.

The results obtained by the methods of physical chemistry are held to indicate the possibility of securing in this way more definite information on the laws governing the exchange of substances between the interior and exterior of the cell. A bibliography is given.

A simplified apparatus for measuring the conductivity of electrolytes, R. P. HIBBARD and C. W. CHAPMAN (*Michigan Sta. Tech. Bul. 23 (1915), pp. 41, figs. 14*).—Attention is called to the value of the Wheatstone bridge for use in biological studies, especially those on the determination of the concentration of solutions and their conductivity. The authors have devised and described some modifications of the apparatus by which it is claimed that greater accuracy and simplicity of operation are secured. The method of operating the apparatus is fully described, and the results are given of some experiments which show the degree of precision obtained.

[Report of the research assistant in plant physiology], R. P. HIBBARD (*Michigan Sta. Rpt. 1915, p. 216*).—In connection with the work reported, a method of determining the mineral salt content of very dilute solutions was worked out (see above).

The agar shake for the detection of members of the coli-aerogenes group, W. GILTNER, C. W. BROWN, and J. C. HURLEY (*Michigan Sta. Rpt. 1915, p. 209*).—Some of the advantages and disadvantages of the agar shake in flask and tube detection of gas-producing bacteria are pointed out.

Some factors influencing the longevity of soil micro-organisms subjected to desiccation, with special reference to soil solution, W. GILTNER and H. VIRGINIA LANGWORTHY (*U. S. Dept. Agr., Jour. Agr. Research, 5 (1916), No. 20, pp. 927–942*).—A report is given of experiments conducted at the Michigan Experiment Station to determine the possibility of a protective effect of the soil solution on soil organisms subjected to desiccation. Suspensions of *Pseudomonas radicicola* in various media were used to determine the protective effect of the solution when dried on sand and the longevity of this organism when dried in quartz sand and in garden loam, and a study was made of the changes in the numbers and kinds of organisms when the solution was dried in different types of soils.

The authors found that the survival of nonspore-bearing bacteria in air-dry soil is due in part to the retention of moisture in hygroscopic form. Bacteria, so far as the species investigated are concerned, resist desiccation longer in a rich clay loam than in sand under the conditions of the experiment. If they are suspended in a solution extracted from a rich clay loam before being subjected to desiccation, they live longer than if subjected to desiccation after suspension in physiological salt solutions.

Attention is called to the fact that not one of the organisms isolated during the last two months of the experiment corresponded to any of the four organisms which predominated in the original soil solution used to inoculate the soils. The extinction of these species, it is thought, may be due to the unfavorable influence of association with other organisms during the period of active multiplication, or to their lack of endurance when supplied with less than the optimum amount of moisture.

The vitality of seeds buried in the soil, W. J. BEAL (*Michigan Sta. Rpt. 1915, pp. 218, 219*).—In continuation of an experiment previously noted (E. S. R., 6, p. 639), an account is given of the vitality of seeds buried in the soil for 36 years. Of 22 different species of weed seed, only *Brassica nigra*, *Capsella bursa-pastoris*, *Lepidum virginicum*, *Rumex crispus*, and *Verbascum thapsus* gave any germination.

Breeding experiments with Œnotheras, W. BATESON, F. KEEBLE, and R. P. GREGORY (*Abs. in Rpt. Brit. Assoc. Adv. Sci., 84 (1914), p. 247*).—This is a report

f the committee on the subject, which has received the report of Gates in ontinuation of his breeding studies previously noted (E. S. R., 32, p. 326). he results of these studies are said to have been confirmed and extended. It as been shown, in particular, that both blending and alternative inheritance f characters occur. Some of the plants are said to emphasize still further the act that mutation and hybridization in Œnothera are separate processes, hich may, however, go on at the same time.

FIELD CROPS.

Cereal experiments in Maryland and Virginia, T. R. STANTON (*U. S. Dept. gr. Bul. 336 (1916), pp. 51, figs. 6*).—This bulletin is for the most part a report n varietal tests in connection with experiments with winter and spring-grown ereals conducted by the Office of Cereal Investigations on the Arlington Farm ince 1907, and in cooperation with the Maryland Experiment Station at College ark since 1904. The results are tabulated and discussed at some length and he leading varieties are grouped and described. The method of conducting the xperiments at both places is outlined, the meteorological conditions for the ifferent years are considered, and the results as a whole are summarized.

The varietal tests at College Park included 107 varieties and races of wheat, of spelt, 3 of emmer, 13 of oats, and 12 of barley, while at the Arlington Farm he tests included 43 varieties and races of wheat, 12 of rye, 4 of spelt, 2 of mmer, 19 of oats, and 56 of barley. Only winter varieties of the various ereals were under test.

Of the winter wheats tested at Arlington Farm, 11 were selections from ybrids developed at College Park and Arlington Farm, and of these Virginia C. I. No. 3277) proved most promising. The 5 leading varieties of wheat at ollege Park, with the 7-year average yield of each in bushels per acre, were as ollows: China, 31.17 bu.; Mammoth Red, 31.09 bu.; Bearded Purple Straw, 0.95 bu.; Turkish Amber, 30.11 bu.; and Lancaster, 30.03 bu. At Arlington arm the 5 leading varieties of winter wheat, with the 5-year average yield of ach in bushels per acre, were as follows: Purple Straw (C. I. No. 1915), 32.09 u.; Lancaster, 29.74 bu.; Dawson Golden Chaff, 29.37 bu.; Fultz, 29.17 bu.; nd Purple Straw (C. I. No. 1957), 29.17 bu. Several varieties of winter wheat t Arlington Farm gave better yields on well-prepared land when sown at the ate of 3 or 4 pk. per acre than when larger quantities of seed were applied.

Among several varieties of winter spelt Alstroum ranked first with a 6-year verage yield of 63.23 bu. at College Park and with a 5-year average yield f 74.08 bu. per acre at Arlington Farm. Black Winter emmer, the only ariety tested, averaged 36.57 and 22.33 bu. respectively, for the same periods at ollege Park and Arlington Farm. The weight per bushel was figured at 0 lbs.

A varietal test of rye was conducted at Arlington Farm only. Of 12 varieties nd selections tested Giant Winter, Virginia Winter, and Abruzzes were the eading sorts. The average yield of Giant Winter rye in a 4-years' test was 2.89 bu. Earlier seeding than commonly practiced by farmers gave very satisfactory results with rye.

The leading varieties of winter oats at College Park were Winter Turf, Bicknell, and Culberson, while the most promising at Arlington Farm were the Red Rustproof, Winter Turf, Bicknell, and Culberson, in the order named. Winter Turf proved the hardiest and most dependable variety, but it is pointed out that its late maturity and tendency to lodge are objectionable and that the Culberson and Bicknell, which mature from ten days to two weeks earlier, are to be preferred to it in eastern and southern Maryland and eastern Virginia.

The leading varieties of winter barley at College Park were Maryland Winter, Mammoth Winter, and Tennessee Winter, varieties practically identical, and at Arlington Farm, Tennessee Winter, Wisconsin Winter, Maryland Winter, and Texas Winter. None of the 18 two-rowed spring barleys grown from fall seeding at Arlington Farm proved satisfactory. A hybrid two-rowed winter barley has been developed which produced an average yield of 25.3 bu. in 1913 and 1914. Varieties of naked barleys also failed to give satisfactory results.

Winter wheat, spelt, rye, barley, and oats gave very satisfactory results, and the varieties most strongly recommended for eastern and southern Maryland and eastern Virginia are as follows: China, Fulcaster, Dietz, Fultz, Purple Straw, Bearded Winter Fife, and Bearded Purple Straw winter wheat; Alstroum winter spelt; Giant Winter, Virginia Winter, and Abruzzes winter rye; Winter Turf, Culberson, Bicknell, and Red Rustproof winter oats; and Tennessee Winter and Wisconsin Winter barley.

Department of farm crops, N. S. Robb (*Idaho Sta. Bul. 84 (1915), pp. 20, 21*).—The best yield of Canada field peas in a seeding test was obtained from seeding at the rate of from 85 to 100 lbs. per acre. The largest yield secured in a test of 9 varieties was 44 bu. per acre.

In 1915 Red Russian stood first in yield with 50.8 bu. per acre among 4 varieties of winter wheat, Early Bart with 35.7 bu. among 3 varieties of spring wheat, and White Smyrna with 84 bu. among 3 varieties of spring barley, including White Winter sown in the spring. In a 5-year test of 3 varieties of winter wheat Red Russian gave an average yield of 43.6, Turkey Red 39.5, and Forty Fold 37.5 bu. per acre. Palouse Bluestem, a spring wheat, grown for 5 years gave an average yield of 37.7 bu. per acre, and in a 3-year test of 3 varieties of spring barley White Winter sown in the spring yielded on the average 72.5, California Feed 62.4, and White Smyrna 61.6 bu. per acre. The average yield for 3 years of White Winter barley sown in the fall was 67.6 bu.

Aberdeen substation, L. C. Aicher (*Idaho Sta. Bul. 84 (1915), pp. 31–35*).—A general description is given of the work in progress, grouped into dry farm and irrigation projects. The dry farm work included rotation experiments, culture tests, and variety and crop trials, and the irrigation work consisted largely of experiments in crop production.

The results of the dry farm projects indicated the value of alternate fallowing and cropping, and that one-way drilling of 3 to 3½ pk. of seed per acre to a depth of 2½ to 3 in. from August 15 to September 15, when moisture conditions are right, on thoroughly tilled, summer fallow plowed 7 in. deep, the crop being given no spring harrowing and the grain being allowed to harden slightly before harvesting, is the most promising practice in growing winter wheat at the substation. Other results are reported as warranting the recommendation of Turkey Red winter wheat for the dry farms in that section of the State.

The best early varieties of potatoes were found to be Early Rose, Early Ohio, and Bliss Triumph, while Pearl was the leading late variety. Promising results are reported with alfalfa, sweet clover, and field peas under dry farm conditions.

The crop work under irrigation indicated that Defiance, Dicklow, and White Bluestem wheats are desirable for spring planting and that Swedish Select and White Bonzana oats, Beldi and Sandrel feed barleys, and Hanna and Chevalier brewing barleys are promising varieties. Results with 22 sorts of field peas were regarded as warranting the recommendation of Amraoti, Wellwood, Lima, and Kaiser for further distribution. It was found that sowing

rom 10 to 12 lbs. of alfalfa seed per acre was ample to insure a good stand nd a good quality of hay. Under irrigation the better yielding varieties of arly potatoes were Early Rose, Early Ohio, and Irish Cobbler; and the later arieties, Idaho Rural, Netted Gem, and Pearl.

Report of the division of farm crops, V. M. SHOESMITH (*Michigan Sta. Rpt. 915, pp. 226–228*).—A general review by F. A. Spragg is given of the crop improvement work of the division. Considerable attention was given to the elimination of error in plat experiments with crops and a method worked out for he purpose and involving the use of a factor called the coefficient of yield s described.

Agronomy (*New Mexico Sta. Rpt. 1915, pp. 35–42*).—In a culture test with orn, dropping the seed behind the plow when plowing stubble ground in the pring was compared with plowing and harrowing the ground and planting vith a corn planter. In connection with the first method irrigation was pplied before and with the second after planting. The yields are reported as n favor of the use of the corn planter by 2.7 bu., and of irrigation before planting by 3.9 bu. per acre. Ten tons of barnyard manure per acre gave an increase in yield of 2 bu. The different varieties grown in the test yielded as follows: Reid Yellow Dent 37.7 bu., Hickory King 40.1 bu., and Mexican June 43.3 bu. per acre. A yield of Mexican June at the rate of 110.3 bu. per re is also recorded. The percentage of stalks and ears attacked by smut given for the different varieties.

In culture tests with wheat, seeding at the rate of 60 lbs. per acre gave tter results than the use of 90 or 120 lbs. of seed per acre, and wheat seeded ovember 1 and December 1 gave much better yields than that seeded on ctober 1, January 1, February 1, or March 1.

An experiment in the eradication of Johnson grass through clean cultivation ave promising results, but reseeding took place through seed carried down om higher levels in the irrigation water.

Sudan grass grown under irrigation yielded per acre 1,894 lbs. from the first, 057 lbs. from the second, and 1,864 lbs. from the third cutting of the season.

First annual report of Vivian experiment and demonstration farm, A. N. LUME, M. CHAMPLIN, and J. G. HUTTON (*South Dakota Sta. Bul. 162, pp. 266–79, fig. 1*).—The history and climatic and soil conditions of the farm are briefly oted, and the lines of work inaugurated together with the plans of conducting he farm are outlined. Some of the year's results with different methods of oil preparation are given in tables but no definite conclusions are drawn. t is stated that the results given will be more completely analyzed in the light f further data and be used later in bulletins dealing with specific subjects.

[Farm crops] (*Washington Sta. Bul. 127 (1915), pp. 13–15, 29, 30, fig. 1*).—'orage crop studies are briefly described and some of the results reported. n a test of growing alfalfa in rows the yields were 7,443, 7,271, and 6,270 bs. per acre from two cuttings from plantings in rows 7, 14, and 28 in. apart, espectively. A variety of alfalfa developing root stocks was found in the orage crop nursery. A mixture of Kentucky blue grass, timothy, orchard grass, brome grass, redtop, alfalfa, red clover, alsike clover, and white clover own in 1912 gave abundant pasturage each year. In 1915 orchard grass predominated, and timothy, Kentucky blue grass, and brome grass had diminished, while there remained only a trace of redtop. Alfalfa persisted better than he other legumes.

A study of the influence of cultivation on the nitrogen content of wheat howed increases in the nursery selections at the station amounting to approximately 33 per cent more nitrogen than was found in the samples taken

from the check plats. Selections made at Grandview showed approximately as much nitrogen in wheat grown with 20 in. of irrigation water as in wheat grown with smaller quantities. Results in 1914 indicated that winter wheat can be grown with a nitrogen content as high as that found in spring grown crops. The percentage of nitrogen in wheat grown at Ritzville was higher than in wheat grown at Pullman, which is ascribed to the more irregular growth and the poorer stand of some of the varieties grown at Ritzville as compared with the Pullman crop.

Farm crop report, E. B. STOOKEY (*Washington Sta., West. Wash. Sta., Mo. Bul., 3 (1916), No. 11, pp. 5–9*).—Brief popular notes are given on variety and crop tests with cereals, clovers, and other legumes, grasses, and miscellaneous forage crops.

Cover crops for Porto Rico, C. F. KINMAN (*Porto Rico Sta. Bul. 19, pp. 32, pls. 8*).—This bulletin discusses the selection of cover crops to meet the conditions of the climate and the requirements of the crops of Porto Rico more especially citrus fruits, coconuts, and pineapples; describes in general the results obtained with different plants grown as cover crops; and enumerates the plants which the station recommends for the purpose, together with a number of wild leguminous plants considered of value in this connection. Descriptive and cultural notes are given of the cowpea (*Vigna sinensis*), jack bean (*Canavali ensiformis*), sword bean (*C. gladiata*), Lyon bean (*Stizolobium niveum*), Bengal or Mauritius bean (*S. aterrimum*), *S. cinereum*, *S. velutinum*, Florida velvet bean (*S. deeringianum*), and the pigeon pea or gandul (*Cajanus indicus*) as cover crops for Porto Rico; and of mani cimarrona (*Chamæcrista diphylla*), matraca (*Crotalaria retusa*), zarzabacoa galana (*Desmodium adscendens*), zarzabacoa común (*D. incanum*), habichuela cimarrona (*Phascolus adenanthus*), yerba rosario (*Eschymomene americana*), conchita peluda (*Centrosema pubescens*), tamarindillo (*Cassia chamæcrista*), habichuela parada (*P. semierectus*), and mato de la playa (*Canavali obtusifolia*) as wild leguminous plants valuable for orchards or other cultivated lands, and worthy of protection and in some instances of cultivation.

Thinning experiments with potatoes, O. B. WHIPPLE (*Montana Sta. Bul. 106, pp. 3–8, fig. 1*).—A preliminary report is presented on thinning experiments with potatoes grown with and without irrigation. The plants were thinned the first two weeks of July to the strongest plant in the hill. The greatest apparent benefit derived from thinning was the decrease in the amount of culls. Although the total yield and the yield of marketable tubers was greatest from the unthinned rows, the quality of the tubers with reference to size and uniformity was better from the thinned crop.

Seed inspection (*Maine Sta. Off. Insp. 73 (1915), pp. 197–224*).—Tables are given showing the results of the examination of samples of seeds collected in the spring of 1915, together with a list of the weed seeds found.

Weeds, J. C. ARTHUR (*Indiana Sta. Rpt. 1915, pp. 31, 32*).—Brief notes on cooperative and demonstration work in the control of wild garlic and Canada thistle by means of spraying with orchard heating oil, red sorrel by sulphate of iron, and of other weeds by the use of a proprietary weed destroyer, are given. A study of weed seeds in the soil was made by taking several samples of soil from different fields and placing them in the greenhouse. In one sample which contained a cubic foot of soil 363 plants came up, and in another 342 plants. In soil from a carefully cultivated field a much smaller number of seeds was found than in one from poorly cultivated ground. Most of the weed seeds were found in the upper 6 in. of the soil.

HORTICULTURE.

Hotbed construction, C. B. SPRAGUE (*Washington Sta. Popular Bul. 98 (1916), pp. 3–15, figs. 5*).—Practical directions are given for the construction and management of hotbeds and cold frames, together with some data on temperature tests of hotbeds under different methods of handling the manure and covering the frame.

The greatest variations in soil temperatures were in beds where no water was applied to the manure when the bed was being made. Beds which had an excess of cold water added to the manure in the making gave the most even temperature but were several days longer in acquiring their maximum temperature. Manure made extremely wet and soggy by the application of cold water does not heat properly. Placing the manure in the pit before it has time to warm through thoroughly causes the temperature to rise slowly and unevenly over the bed. Although excessive packing by tramping and tamping with heavy tampers retards the heating at the start, the tests suggest that the life of the manure bed will be lengthened by this practice. The air readings in the beds covered with single glass sash were higher in the daytime and lower at night than those under double glass sashes.

The commercial grading, packing, and shipping of cantaloups, C. T. MORE and G. V. BRANCH (*U. S. Dept. Agr., Farmers' Bul. 707 (1916), pp. 23, figs. 18*).—This publication is designed to aid growers and shippers in preparing their cantaloups for market in such a way that they may realize higher average returns with fewer losses. The subject matter is based on the results of careful observations of grading, packing, and shipping operations as now conducted by the most progressive growers and shippers in some of the best commercial cantaloup sections of the country, together with investigations of cantaloup-marketing conditions in many of the larger cities.

The tomato, R. ROVETTA (*Il Pomodoro. Milan: Ulrico Hoepli, 1914, pp. XV+279, pl. 1, figs. 89*).—A manual of information relative to tomato culture and the preparation of various tomato products such as canned tomatoes, tomato sauce, and paste. Information is also given relative to the utilization of the refuse as stock feed and fertilizer, including the manufacture of tomato-seed oil and its adaptation for various purposes. The various types of machinery and equipment used in the preparation of tomato products are described.

Texas orchard and nursery inspection laws and digest of the laws and regulations of the different States, covering interstate shipment of nursery stock, E. L. AYERS (*Texas Dept. Agr. Bul., n. ser., No. 19 [1916], pp. 29*).—The laws and regulations here noted deal both with insect pests and plant diseases.

Influence of low temperature on fruit growing in New York State, W. H. CHANDLER (*Cornell Countryman, 13 (1916), No. 5, pp. 373–377, figs. 4*).—A popular discussion of various types of injury to fruit trees caused by low temperature.

[Report of horticultural investigations] (*New Mexico Sta. Rpt. 1915, pp. 55–65, figs. 2*).—Data are given showing the dates of blooming and picking and yields and returns from the different varieties in the experimental peach orchard. Experiments dealing with the winter treatment of Vinifera grapes were continued. The data obtained show the advantage of winter protection. Covering the vines with moist soil during the winter appears to be an actual benefit to them. A table is given showing the average yield per vine, the actual yield per plat, and the estimated yield per acre for the different varieties under different methods of winter treatment. A test of the newer varieties of plums and sweet and sour cherries was started during the year. A plan is given of the test orchard, together with a list of the varieties planted.

The results of spraying Bartlett pears for the codling moth indicate that it can be successfully controlled with four sprayings. The observations of the station continue to show that a larger percentage of the fruit is stung in places other than the calyx end. A preliminary test as to the keeping quality of Bartlett pears is also noted.

[Report of the] department of horticulture, C. C. VINCENT (*Idaho Sta. Bul. 84 (1915), pp. 21–26*).—In this brief progress report on horticultural investigations for the year, lists of apple crosses made for the 6-year period, 1910 to 1915, are included.

A pruning experiment which has been conducted to determine the relative merits of summer *v.* winter pruning of apple trees has shown for a 4-year period an increased yield in favor of summer pruning. The increase ranged from 1.6 per cent in the case of Rome Beauty trees to 111 per cent in the case of Wagener trees. Higher colored fruit was also secured in the summer pruned plats.

Dusting and spraying experiments with apples, D. REDDICK and C. R. CROSBY (*New York Cornell Sta. Bul. 369 (1916), pp. 309–356, pls. 4, figs. 9*).—The experiments herein reported were undertaken during the 1915 season for the purpose of confirming the results of previous experiments by the authors and by Blodgett (E. S. R., 32, p. 836). Spraying experiments were conducted in five orchards in different sections of western New York. Comparisons were made of the various dusted plats with plats of trees treated with the standard spray materials, lime-sulphur solution and lead arsenate, and with a plat of trees that received no summer treatment. Details as to quantities of materials used, dates of application and conditions influencing the same, time required, comparative costs, and results are given in connection with the individual experiments.

The previous work indicated that satisfactory insect control could be secured with a dust mixture containing 90 per cent sulphur and 10 per cent of arsenate of lead. This result was confirmed in the present experiments. As a general formula for use in western New York under average western New York conditions, however, the authors recommend a mixture containing 85 per cent of exceedingly finely ground sulphur and 15 per cent of powdered arsenate of lead applied in amounts of from 1.25 to 2.5 lbs. per tree in each application. The experiments indicate that 15 oz. of finely ground sulphur applied per tree in each application will give effective control of the scab disease and of sooty blotch. So far as can be determined the sulphur can be applied directly in this amount. The results in one experiment, however, indicate that the use of a filler allows for better distribution. Terra alba, or finely ground gypsum, used in equal parts with sulphur is a satisfactory filler.

In some of the experiments a number of substances were added to the dust mixtures to determine whether their destructive properties could be increased thereby. These substances included hydrated lime, finely ground gypsum or terra alba, finely powdered soap, and casein and lime. The dust mixtures were apparently not improved by any of the diluents used.

As in the previous work the experiments show that powdered sulphur applied dry does not adhere as well as sulphur applied in liquid form as in lime-sulphur solution, or as the very fine sulphur precipitated from the solution on the addition of arsenate of lead or an acid substance. In every case but one in which scab was a factor the percentage of scab on the dusted plats was greater than on the sprayed plats, although in some cases the difference was slight.

Summing up the station's dusting experiments as a whole the authors conclude that a mixture of an insecticide and a fungicide can be applied in

powdered form, using air as a carrier, with better commercial results in the control of preventable apple diseases and of apple insects than can be obtained by spraying. Some general suggestions based on the experimental work are given relative to spraying materials, method, thoroughness, and time of application, home mixing of materials, applicability of the dust method, and equipment.

Blight-resistant roots.—**The first step toward pear blight control,** A. L. WISKER (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 2, pp. 48–53, fig. 1*).—An address before the State Fruit Growers' Convention, at Palo Alto, Cal., in July, 1915, in which the author deals particularly with our present knowledge of blight-resistant roots.

The taxonomic value and structure of the peach leaf glands, C. T. GREGORY (*New York Cornell Sta. Bul. 365 (1915), pp. 183–222, figs. 98*).—The investigation here reported was undertaken primarily to determine whether peach leaf glands are sufficiently stable and uniform in their characters to be used as a basis for separating the varieties into sections. The leaves used in the work were obtained from the peach district along Lake Ontario, from the Missouri Fruit Station, and from the New York State Station at Geneva.

The glands of all the leaves were carefully examined and are here discussed with reference to their morphology, physiology and histology, comparison with the spines of the leaf, secretory process, decomposition, and variability. A number of drawings of certain glands are also included. The available literature on the subject was consulted and is here listed.

Among the varieties studied four kinds of leaves were found, those with reniform glands, those with globose glands, glandless leaves, and leaves having mixed or indistinctive glands. The great majority of varieties were found to have very definitely shaped glands, whereas other varieties were found that were not adapted to any fixed classification because of the variability of the glands. In view of this variability in conditions it is considered inadvisable to attempt a definite classification into sections, but a list of varieties is given with their gland characteristics, the commercial varieties of New York State being especially considered and illustrated.

The structure of the glands shows that they are true glands having an upper layer of long, rectangular, secretory cells that produce a sweet substance, the function of which is not apparent. After the glands have ceased secreting they begin to decay and slowly disappear until almost nothing is left. The decaying process is preceded in every case by a suberization and thickening of the cell walls. A study of the transitional forms indicates that the glands are merely modified leaf spines. The leaves with reniform glands are apparently the highest type and the glandless leaves the lowest type. Whenever typical glandless leaves become possessed of glands they are always of the globose type. The margins of normally glandless leaves are deeply and doubly serrate while the margins of leaves with glands are always single and crenate. The development of glands on a normally glandless leaf is accompanied by the transformation of the serrations to crenations.

Cost of a peach orchard, C. J. HAYDEN (*Country Gent., 81 (1916), No. 7, p. 329*).—Data are given on the cost of establishing and maintaining a peach orchard of 10,000 trees during the first three years.

Report on experiment in picking, packing, handling, cool storage, and transportation of peaches, E. MEEKING (*Jour. Dept. Agr. Victoria, 14 (1916), No. 1, pp. 41–55, figs. 3*).—Tabular results are given on some cooperative peach

picking, packing, handling, cool storage, and transportation experiments conducted under the direction of the Victoria Department of Agriculture.

Size grades for ripe olives, F. T. BIOLETTI (*California Sta. Bul. 263 (1916), pp. 215–227, figs. 2*).—In this bulletin the author discusses the uses and methods of sizing olives, presents data showing a great variation in the present practice of sizing, and describes some work conducted with a view to establishing a basis for a common standard.

An attempt was made to discover the relation between diameter and number of olives per pound. This relation, however, was found to vary according to the shape of the olive and its specific gravity. From a large number of weighings and measurements a factor has been determined for each of several of the principal pickling olives from which the number of olives to the pound for the various sizes may be determined. This factor differs for each variety of different shape, and varies especially with the change in ratio between length and thickness of the olive. Various systems of size grading with reference to diameter are compared and a grade based on a difference in diameter of 88 per cent is proposed. In this system of grading each grade is almost exactly 88 per cent of the average diameter of the next larger grade and weighs 68 per cent as much per pound. The number of olives to the pound would be inversely proportionate to the weight and the number for each grade would be 68 per cent of the next smaller grade.

Results of reconstitution in Sicily, F. PAULSEN (*Bul. Agr. Algérie, Tunisie, Maroc, 21 (1915), No. 8, pp. 189–206*).—A review of progress made during the past 25 years in the reconstitution of phylloxera-infested vineyards by the use of American vines as stocks, with special reference to work conducted at the Royal Nursery of American Vines of Palermo.

Mulching the citrus orchard, D. C. FESSENDEN (*Cal. Citrogr., 1 (1916), No. 4, p. 25*).—A brief résumé of mulching experiments in citrus orchards in southern California that are being conducted by a number of private interests, as well as by the state experiment station and the U. S. Department of Agriculture.

Bud sports in agriculture, C. S. POMEROY (*Cal. Citrogr., 1 (1916), No. 4, pp. 16, 17, fig. 1*).—The author briefly cites instances of bud sports in fruit trees and other plants, special reference being made to some results secured by the Bureau of Plant Industry of the U. S. Department of Agriculture in bud selection work with citrus fruits in California (E. S. R., 34, p. 639).

Notes on the budding of cacao on an estate scale in Trinidad, W. G. FREEMAN (*Proc. Agr. Soc. Trinidad and Tobago, 16 (1916), No. 1, pp. 22–28*).—The author gives a brief general statement of progress made in budding cacao, together with an outline of experiments in budding and grafting cacao that are being conducted on an estate in Trinidad.

Diseases and pests of the coconut in Netherlands India, P. E. KEUCHENIUS (*Teysmannia, 26 (1915), No. 10, pp. 601–614*).—Descriptive notes are given on a number of insect pests and diseases of the coconut, including a short bibliography of related literature.

Pecan culture, with special reference to propagation and varieties, C. A. REED (*U. S. Dept. Agr., Farmers' Bul. 700 (1916), pp. 32, figs. 17*).—A practical treatise on pecan culture, in which consideration is given to the economic importance of the pecan, native range, cultural distribution, soil and moisture requirements, propagation, seed selection, care of the seed, planting the seed, comparison of budded and grafted trees, cleft grafting, formulas for grafting wax, preparation of grafting cloth, care of cleft grafts, nursery whip grafting, care of whip grafts, annular budding, patch budding, care of annular and patch buds, chip budding, length of time trees should remain in the nursery, the pres-

rvation of nut-bearing forests, top-working, trees suitable for top-working, ow to top-work, top-working the hickory with the pecan, planting, cultivation, earing age, present prices of the nuts, marketing pecans, the selection of arieties, "papershell" pecans, and varieties.

Included in the discussion of varieties are lists of varieties which have roved most promising in different sections of the pecan region, together with lescriptions of the more important varieties taken largely from Bulletin 251 f the Bureau of Plant Industry, previously noted (E. S. R., 27, p. 645).

Intensive cultivation of ornamental plants, M. GAJON (*Estac. Agr. Cent. Mexico*] *Bol. 9–12 (1914), pp. 102, figs. 41*).—A popular treatise with special eference to Mexican conditions. Descriptive notes are given on flowering nd other ornamental plants suitable for culture in pots or in gardens.

Climbing plants, W. WATSON (*London and Edinburgh: T. C. & E. C. Jack 1916], pp. X+132, pls. 24*).—A popular treatise on climbing ornamental plants, liscussing the various classes of climbers, their adaptation, and specific cultural equirements.

The daffodil yearbook, 1915 (*London: Roy. Hort. Soc., 1915, pp. VII+135, ls. 33*).—A compendium of articles by various authorities, dealing with different phases of daffodil culture, new varieties, breeding work, adaptation of laffodils for various situations and purposes, dates of flowering of different arieties, reports of shows, and other information. A bibliography on daffodils s appended.

The amateur orchid cultivators' guide book, H. A. BURBERRY (*Liverpool: Blake & Mackenzie, Ltd., 1915, 4. ed., pp. VIII+182, pls. 9, figs. 24*).—A textook and guide to the study of orchids and their culture.

In addition to cultural directions for orchids in general, information is iven relative to specific requirements of various classes of orchids, together with lists of varieties that may be grown in cool, intermediate, and warm greenhouses. The present edition of the work embodies the results of recent experiences in orchid culture, and includes a new chapter on the culture of *Odontoglossum crispum*. Instructions for the treatment of orchids throughout the year are presented in tabular form and a number of questions and answers relating to orchids are included.

The home grounds, E. G. DAVIS and R. W. CURTIS (*New York Cornell Sta. Bul. 361 (1915), pp. 293–435, figs. 61*).—In part 1 of this bulletin the first-named author discusses some elemental principles and furnishes concrete directions dealing with the arrangement of the home grounds. Consideration is given to the house, roads, and walks, and other surroundings; grading and planting; improving the outlook; nature and character of plantings; selection of trees; the use of shrubs; and flower gardens. In part 2 the last-named author has prepared lists of plant materials to be used in selecting the proper trees, shrubs, and smaller growths suitable for home grounds. The lists are prepared with due reference to various types of planting; different soil, light, and moisture conditions; and for securing different effects with reference to color of foliage, fruit, flower, etc.

A historical sketch of the Royal Botanic Gardens, Peradeniya, H. F. MACMILLAN (*Trop. Agr. [Ceylon], 46 (1916), No. 1, pp. 4–9, pls. 4*).—A brief résumé of the development of the Royal Botanic Gardens since their location in Peradeniya in 1821.

FORESTRY.

Woodlot conditions in Broome County, New York, F. B. MOODY and J. BENTLEY, Jr. (*New York Cornell Sta. Bul. 366 (1915), pp. 227–244, figs. 6*).—This bulletin embraces the results of a survey of woodlot conditions conducted

in Broome County in 1914. It describes the present condition of the woodlot, including topography and soil, distribution of forest and woodland, forest types, and past treatment of woodland. Suggestions are then given relative to methods of treatment whereby these conditions can be improved and the woodlots made to yield a regular income to their owners. In this connection information is given relative to species suitable for planting in Broome County and assistance rendered to landowners by the State in securing planting stock and in granting relief from taxation on woodland. A list is also give of the important commercial species and the economic uses of their wood.

Two demonstration areas have been located in the county with the view of furnishing examples of applied forestry.

Woodlot conditions in Dutchess County, New York, F. B. MOODY and J. BENTLEY, JR. (*New York Cornell Sta. Bul. 368 (1915), pp. 283–302, figs. 8*).—A report similar to the above on woodlot conditions in Dutchess County, N. Y.

Cooperative shelter-belt planting on the northern Great Plains (*U. S. Dept. Agr., Bur. Plant Indus., Office Dry-Land Agr. Doc. 1 (1916), pp. 6*).—This pamphlet outlines the cooperative shelter-belt planting in the northern Great Plains as conducted under the direction of the Office of Dry Land Agriculture and describes the conditions under which a cooperative shelter-belt planting is made. The territory covered by the work is that part of North Dakota and South Dakota lying west of the one hundredth meridian and of Montana and Wyoming which lies east of the 5,000-foot elevation.

Cooperative shelter-belt development in the northern Great Plains (*U. S. Dept. Agr., Bur. Plant Indus., Office Dry-Land Agr. Doc. 2 (1916), pp. 3, fig. 1*).—This pamphlet contains instructions for the planting and care of trees and has been prepared with special reference to its use by shelter-belt cooperators. See above abstract.

The spruce and balsam fir trees of the Rocky Mountain region, G. B. SUDWORTH (*U. S. Dept. Agr. Bul. 327 (1916), pp. 43, pls. 35*).—This bulletin deals with the distinguishing characters, geographic distribution, and forest habits of all of the spruce and balsam fir trees that grow naturally within the Rocky Mountain region, including also Canadian territory lying directly north of the Rockies and Mexican territory adjacent to the Southwest. Keys are provided for the identification of the genera and species.

The bamboos in the cordilleras of the South, C. K. HOSSEUS (*Bol. Min. Agr. [Buenos Aires], 13 (1915), No. 3–4, pp. 195–208, figs. 8*).—An account of the bamboos in the Andes region of South America with reference to their characteristics, distribution, forestal importance, importance to the industries, influence on agriculture, and use for protection against wind.

Observations on some reputed natural eucalyptus hybrids, together with descriptions of two new species, J. H. MAIDEN and R. H. CAMBAGE (*Jour. and Proc. Roy. Soc. N. S. Wales, 48 (1914), pt. 3, pp. 415–432*).—In this paper three reputed natural eucalyptus hybrids are discussed, and two of them are named and described as *Eucalyptus kybeancusis* n. sp. and *E. benthami* n. sp.

Notes on Eucalyptus (with a description of a new species) No. 3, J. H. MAIDEN (*Jour. and Proc. Roy. Soc. N. S. Wales, 48 (1914), pt. 3, pp. 423–432*).—A new species, *Eucalyptus præcox*, is described and notes are given on six previously published species.

Notes on some forest species of Madagascar, E. PERROT and A. GÉRARD (*Bul. Écon. Gouvt. Gén. Madagascar, 15 (1915), I, No. 1, pp. 73–79, figs. 4*).—The principal wood characteristics of a number of Madagascar forest trees are briefly noted.

A review of the net revenues from the Saxony state forests for the year 1913, WAPLER (*Tharand. Forstl. Jahrb., 66 (1915), No. 6, pp. 420–431*).—A statistical review relative to the yield in major and minor forest products, revenues, expenditures, etc., for the various districts of Saxony for the year 1913.

Annual progress report upon state forest administration in South Australia for the year 1914–15, W. GILL (*Ann. Rpt. State Forest Admin. So. Aust., 1914–15, pp. 13, pls. 7*).—This is the usual report relative to the administration and management of the state forests in South Australia, including a financial statement for the year ended June 30, 1915. Data relative to forest areas, planting and other forest operations, revenues, expenditures, etc., are presented in tabular form.

[Report of the forestry division], J. M. PURVES (*Nyasaland Dept. Agr., Ann. Rpt., 1915, pp. 25–28*).—A brief progress report on operations in the forest nurseries and plantations in Nyasaland, together with a financial statement for the year.

Progress report of the Forest Research Institute for the year 1914–15, L. MERCER (*Rpt. Forest Research Inst. [Dehra Dun], 1914–15, pp. 22*).—A progress report of investigations in silviculture, forest botany, forest economy, forest zoology, and forest chemistry. Lists of recent publications and of all publications issued since the institute was established are appended, together with a financial statement for the year.

Forestry in Netherlands India, C. S. LUCT (*Het Boschbedrijf in Nederlandsch Indië. Haarlem: H. D. Tjeenk Willink & Son, 1912, pp. 125, pl. 1, figs. 35*).—This is the second of a series of handbooks dealing with the agricultural products of the Dutch East Indies.

The present work takes up the history, development, administration, and exploitation of teak and wild timber forests on Java and other islands of Netherlands India. Information is also given relative to cultural operations, transportation, yields, and revenues from forest operations.

Suggested alterations in the law relating to estate forestry, B. W. ADKIN (*Quart. Jour. Forestry, 10 (1916), No. 1, pp. 1–9*).—In this paper the author recommends certain changes in laws pertaining to timber estates in England.

Practical forest assessment and survey, E. H. F. SWAIN (*Dept. Forestry, N. S. Wales, Bul. 9 (1914), pp. 16, figs. 3*).—The system of forest strip survey here outlined is an Australian adaptation of the methods adopted by European and American forest services and timber firms.

Collection of statistics, W. SCHLICH and L. S. WOOD (*Quart. Jour. Forestry, 10 (1916), No. 1, pp. 42–51*).—In this article the authors give suggestions for the collection of forest data in Great Britain to be used in the preparation of volume tables and preliminary tables of the volume and value increment of trees and woods. Sample measurements of 36 beech trees are given in order to explain the method recommended.

Preservative treatment of fence posts, G. B. MACDONALD (*Iowa Sta. Bul. 158, abridged ed. (1915), pp. 3–31, figs. 8*).—An abridged edition of the bulletin previously noted (E. S. R., 34, p. 153).

DISEASES OF PLANTS.

Some observations on the study of plant pathology, G. MASSEE (*Jour. Econ. Biol., 10 (1915), Nos. 1–2, pp. 29–48*).—This is a somewhat general presentation of results of the author's observations on diseases of plants, resistant varieties, distribution of disease, legislation in this connection, the training of plant pathologists, and the mycoplasm theory.

The author is of the opinion that an academic knowledge of mycology alone is of comparatively little value from the standpoint of arresting plant diseases, owing to the large number of factors which may be operative.

The claim recently made, on the basis of a study of silver leaf disease, that this disease may apparently be due at times to the fungus *Stereum purpureum* and at others to undetermined physiological causes, is regarded as justifying alarm if it proves to be indicative of a possibility more or less general.

Plant diseases, J. C. ARTHUR (*Indiana Sta. Rpt. 1915, pp. 29–31*).—The author briefly reviews the investigations in plant diseases conducted during the year covered by the report. These include studies on grass and sedge rusts, control of oat smut and potato scab, soil sanitation, and the results of a plant disease survey of the State.

In connection with the work on control of oat smut, various forms of machines for treating the grain have been tested, some of them with considerable success. Further experiments with hydrogen peroxid for the prevention of stinking smut of wheat and smut of oats indicate that this chemical can not be used effectively as a grain disinfectant.

In the notes from the plant disease survey, a dozen or more diseases are reported for the first time as occurring in this State.

[Report of the research assistant in plant pathology], G. H. COONS (*Michigan Sta. Rpt. 1915, pp. 213–215*).—One of the principal studies of the year reported was that a serious canker of apple due to *Plenodomus* sp., a portion of which has already been reported upon (E. S. R., 34, p. 647).

Among reports of other investigations, an account is given of experiments on potato seed treatment, the results confirming those previously noted (E. S. R., 31, p. 543). A disease of celery characterized by stunted growth is briefly described. This trouble is said to be serious in a number of centers of celery production, in some cases causing almost total loss. As a result of this study, the author considers the disease of bacterial causation. Attempts were made to determine control measures, and among the most promising was soil sterilization.

Diseases and enemies of cultivated plants in the Dutch East Indies, A. A. L. RUTGERS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Mededl. Lab. Plantenziekten, No. 9 (1914), pp. 24*).—Notes are given on diseases of plants as observed, including *Phytophthora faberi*, *Corticium salmonicolor*, *C. javanicum*, *Fomes semitostus*, *Hymenochæte noxia*, *Thyridaria tarda*, and *Phyllosticta* sp. on rubber trees; a leaf curl and a bacterial disease of peanuts; Piricularia and Helminthosporium on rice; Phytophthora on tobacco; Helopeltis, Pestalozzia, Læstadia, *Cephaleuros virescens*, Nectria, Corticium, and Hypochnus on tea; *Corticium javanicum*, Colletotrichum, and *Hemileia vastatrix* on coffee; and diseases of unspecified causation, besides a number of insect enemies of cultivated plants.

A list of related publications issued in 1913 is also given.

Germination conditions of teleutospores of Uredineæ, III, P. DIETEL (*Centbl. Bakt. [etc.], 2. Abt., 42 (1915), No. 25, pp. 698–705*).—In continuation of previous work (E. S. R., 28, p. 241), the author has found that spores of *Puccinia malvacearum* on mallow require for entirely normal development an atmosphere fully saturated with water vapor. It is stated that the period of exposure to unsaturated air necessary to complete loss of germinability is shortened as the humidity decreases.

Recent data and questions regarding smoke injury to plants, F. W. NEGER (*Naturw. Wchnschr., 29 (1914), No. 34, pp. 529–534, figs. 5*).—This is a condensed account, with a brief bibliography, of observations on gases injurious

to vegetation, some of which have already been noted (E. S. R., 34, p. 523), including such features as concentration, precipitation forms, soil factors, structural peculiarities, physiological relations, and temperature.

Examination and estimation of the damage caused to vegetation by the smoke and vapors from factories, F. RANWEZ (*Chem. News, 112 (1915), No. 2913, p. 151*).—This is a note on the injuries and problems arising in connection with the fumes, chiefly sulphur dioxid, from industrial plants.

A convenient casein spray, V. VERMOREL and E. DANTONY (*Rev. Vit., 43 (1915), No. 1091, p. 448*).—Directions are given for the convenient preparation of a solution which is said to keep indefinitely in closed vessels.

Powdered casein is dissolved in ten times its own weight of water, which is stirred rapidly in the meanwhile and also while about the same proportion of milk of lime is added.

To make a spray which possesses both adherent and spreading qualities the above preparation is added to 100 times its volume of alkaline Bordeaux mixture.

The use of copper carbonate as a fungicide, G. P. DARNELL-SMITH (*Agr. Gaz. N. S. Wales, 26 (1915), No. 3, pp. 242, 243*).—In order to avoid the possible bad effects of wetting the seed wheat in treating for bunt, the use of dry copper carbonate has been tested at the Wagga and Cowra experiment farms for two years with good results thus far as regards both germinability and freedom from bunt.

The method of applying the treatment was to shake up a bushel of the seed wheat in a bag with 4 oz. of copper carbonate. The powder readily adheres to the brush of the grain, where the bunt spores mostly adhere, and to the longitudinal groove of the seed.

Teleutospore formation by the cereal rust fungi, G. GASSNER (*Ztschr. Bot., 7 (1915), No. 2, pp. 65–120*).—Details are given of extended observations made in the subtropical regions of South America on the progress of teleutospore formation by *Puccinia triticina, P. graminis, P. coronifera,* and *P. maydis,* and on the developmental relations between host and fungus.

The dependence of teleutospore formation upon weather appears to be indirect and due to the part played by the weather in determining the developmental stages of the host. *P. graminis* requires, in order to begin the formation of teleutospores, a more advanced developmental stage in the host plant than do *P. triticina* and *P. coronifera*. *P. maydis* also depends upon the developmental stage of its host, as observable in varieties showing differences in developmental rates and in the periods required to reach the flowering stage.

Puccinia oryzæ parasitic on rice in the Ebro Delta, Spain, J. FLORENSA Y CONDAL (*Sindicato de Riegos del Delta Derecho del Ebro, la Enfermedad del Arroz (Puccinia oryzæ). Tarragona, 1914, pp. 32; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 3, pp. 469, 470*).—A destructive disease of rice which appeared in July, 1914, in the Ebro Delta is attributed to *P. oryzæ*. Its progress is thought to be favored by soil fatigue; high-water level; lack of care in selection and disinfection of seed; excess of nitrogen in fertilizers deficient in phosphates, potash, and iron; persistent humidity; cool weather during the period from germination to flowering of the rice; close planting; and the presence of weeds.

Remedial measures thus far have proved to be expensive and impracticable.

Preventive measures recommended include the burning of all vegetation on the ground after the removal of the straw, which should be disinfected with a 4–5 per cent solution of copper sulphate or with milk of lime; disinfection of the soil with lime or carbon disulphid; maintenance of a low water level (not over 7 or 8 in.); use of resistant varieties of rice, with constant selection there-

from; avoidance of suspected seed, or treatment thereof as directed; destruction of weeds on embankments; spacing from 10 to 14 in. apart; and rotation of crops or of varieties where possible.

[Report of the assistant in plant pathology], J. H. MUNCIE (*Michigan Sta. Rpt. 1915, p. 217*).—The author's investigations have been confined to a study of bean diseases, particularly in connection with measures for control of anthracnose and blight. It is believed that by growing early-maturing varieties of beans to a large extent the losses hitherto reported might be eliminated. Some experiments are being carried out to determine whether or not the bean disease organisms may winter over in the soil and attack the next year's crop.

Pseudomonas phaseoli in beans, W. GILTNER, C. W. BROWN, and S. T. SAPIRO (*Michigan Sta. Rpt. 1915, p. 208*).—On account of the possibility of seed bean infection, the authors have made an examination of the presence of bacteria causing bacteriosis of beans.

It was found that seed from diseased pods may or may not contain the causal organism, and that healthy-looking, clean beans from diseased pods may contain, a few weeks after ripening, from 100,000 to 3,000,000 bacteria per bean, while discolored ones may contain from 1,000,000 to 100,000,000 bacteria. Only 4 out of 27 discolored beans which had been kept for a year in a dry room showed the presence of living bacteria. As *P. phaseoli* was found to make fair growth on nutrient agar containing 2 per cent copper sulphate, the treatment of beans with copper sulphate is not considered of much value in the control of bean bacteriosis.

Phytophthora disease of gingseng, J. ROSENBAUM (*New York Cornell Sta. Bul. 363 (1915), pp. 63–106, figs. 17*).—The results are given of a study carried on in cooperation with this Department of the Phytophthora disease of ginseng, which was first reported in the United States by Van Hook (E. S. R., 18, p. 342) and which was studied by Hori in Japan (E. S. R., 19, p. 752). The symptoms of the disease, its cause, pathogenicity of the organism (*P. cactorum*), the life history, and the morphology of the fungus are described at length, after which results of experiments in control are given. Spraying with fungicides, removal of diseased tops or roots of plants, deep planting, crop rotation, sterilization of the soil, and adequate drainage are suggested.

Spraying of peanuts for leaf rust, W. NOWELL (*Agr. News [Barbados], 14 (1915), No. 352, p. 350*).—Information taken from a report by W. Robson regarding spraying for the control of peanut rust (*Uredo arachidis*) indicates that the fungus is effectively controlled by spraying with Bordeaux mixture, the yield being increased about 28 per cent in one instance.

The degree of infestation by this fungus depends largely upon conditions of soil and climate. Under favorable conditions only those leaves which are approaching senility are attacked, but unfavorable circumstances result sometimes in the death of the whole plant. This fact leads to varying results from spraying at different times and places.

Studies of health in potatoes, C. L. FITCH (*Colorado Sta. Bul. 216 (1915), pp. 3–31, figs. 17*).—On account of the serious losses experienced by potato growers in parts of Colorado, the author made an investigation of some of the factors which influence the health of the potato plant. Field and laboratory studies were made of soil temperature, moisture, irrigation, and the roots and leaves of the potato plant.

The conclusion was reached that high soil temperatures, which occur in years of more than average sunshine, and soakage of soil causing a lack of aeration are among the most important factors contributing to the loss. The presence of hyphæ of Fusarium was noted in unhealthy plants, but it is thought that the occurrence of the Fusarium is secondary to the effects produced by unfavorable

soil conditions. Leaf roll was widely reported in the potato districts of Colorado for several years, but it is thought to have almost completely disappeared in 1915.

[Infection of sugar beets through the seed], P. SORAUER (*Ztschr. Pflanzenkrank., 24 (1914), No. 8, pp. 449–462*).—This is a discussion of the various fungi and bacteria which are introduced into the soil with seed or mother beets, and the developmental relations between these organisms and their host plants.

Soil stain, or scurf, of the sweet potato, J. J. TAUBENHAUS (*U. S. Dept. Agr., Jour. Agr. Research, 5 (1916), No. 21, pp. 995–1002, pls. 2*).—The results are given of an extended study at the Delaware Experiment Station of the soil stain, or scurf, of sweet potatoes due to *Monilochætes infuscans* (E. S. R., 2, p. 416). This disease is said to occur in practically all sweet potato regions and is abundant in heavy soils, especially where manure has been used as a fertilizer. It is said to reduce the market value of the roots and also to reduce the yield by attacking the young roots and stunting their development. The fungus is said to be difficult to culture, as it is of very slow growth and readily overgrown by associated saprophytes. A description of the fungus as obtained from pure culture is given.

[Practical protection for plants], JUNGE (*Ber. K. Lehranst. Wein, Obst u. Gartenbau Geisenheim, 1913, pp. 27–30*).—American gooseberry mildew appears to have been dealt with effectively by careful removal of affected tips and thorough pruning with a view to light admission.

Fusicladium was not controlled by use of Bordeaux mixture or of lime sulphur.

The use of heating devices for preventing injury to orchard fruits was not effective when the temperature sank as low as —4° C.

Fire blight, L. R. TEHON (*Bien. Rpt. Wyo. Bd. Hort., 5 (1913–14), pp. 59–64, figs. 3*).—It is stated that fire blight (*Bacillus amylororus*) is fast getting a hold upon the orchard district of Wyoming, practically every orchard in Crook County being infected in 1914.

The transmission, symptoms, and progress of the disease are discussed. Trees in vigorous growth, forming abundant new, succulent tissue, are particularly susceptible. The organism can not endure severe drying.

Continual inspection with destruction of all infected material constitutes the only available means of protection. The organism overwinters in the cankers on the fruit trees, and on mountain ash, service berry, and haw.

Dusting nursery stock for the control of leaf diseases, V. B. STEWART (*New York Cornell Sta. Circ. 32 (1916), pp. 10, figs. 5*).—On account of the reported success of dusting apple orchards for control of diseases the author has investigated the practicability of this treatment for the control of leaf diseases of cherry, rose, currant, and horse-chestnut. The dust mixture used in all the experiments was composed of 90 parts of finely ground sulphur and 10 parts of powdered lead arsenate. The results obtained were so successful that further trial on a more extensive scale is considered advisable.

The use of lime sulphur as a summer spray for apple scab, C. C. VINCENT (*Idaho Sta. Bul. 84 (1915), pp. 26, 27*).—A brief preliminary report is given of the results of spraying for the control of apple scab. Three applications of lime sulphur resulted in a crop 95 per cent of which was sound, as compared with 10 per cent from untreated trees. The applications were made when the buds began to show pink, when the petals fell, and four weeks later.

Plum wilt, its nature and cause, B. B. HIGGINS (*Georgia Sta. Bul. 118 (1916), pp. 3–29, figs. 25*).—A disease of Japanese plums and of hybrid varieties of Japanese parentage, known as wilt, is said to have been under observation

at this station for several years (E. S. R., 17, p. 466). In the fall of 1913 the author began a study to determine the identity of the organism, means of infection and spread of the disease, its course of development, and the possibility of control.

The cause of the wilt has been determined to be a species of Lasiodiplodia, to which the name *L. trifloræ* n. sp. has been given. The fungus infests principally the conducting tissue and the medullary rays of the wood, causing gum formation. The sudden wilting is considered due to a loss of water supply through the deposits of gum in the conducting elements of the wood. The fungus, it is said, can not enter through the unbroken bark, but readily enters through wounds, and a large proportion of the infections occur through wounds caused by peach borers.

For the prevention of this trouble, the author recommends the cleaning out of channels made by peach borers and removing, if necessary, the surrounding infected tissue, after which the surface is sterilized with corrosive sublimate and covered with grafting wax to prevent infection. Bacterial cankers and other wounds should be treated in the same manner.

[Control of plant diseases and insect enemies], G. LÜSTNER (*Ber. K. Lehranst. Wein, Obst u. Gartenbau Geisenheim, 1913, pp. 97–100*).—A brief discussion is given of tests made with several commercial preparations offered for use against Peronospora and Oïdium on grapevines and also against injurious insects.

Control of grape diseases, M. LINDNER (*Ztschr. Obst u. Gartenbau, 40 (1914), No. 7, pp. 101–104, figs. 4; abs. in Mycol. Centbl., 5 (1915), No. 6, p. 297*).—Directions are given for the employment of Bordeaux and Burgundy mixtures against *Peronospora* (*Plasmopara*) *viticola*, and of sublimed or powdered sulphur against *Oïdium tuckeri*.

The copper content of fungicidal sprays (*Rev. Vit., 42 (1915), No. 1092, pp. 469, 470*).—The copper content of Bordeaux and of Burgundy mixtures in common practice is said to have decreased from a concentration of about 8 per cent in the early stages of its employment to about 2 per cent at the present time. It is thought that the latter concentration should be employed, perhaps twice, about the time when the blooms are open, but that 1.5, 1, or even 0.5 per cent may be sufficient under ordinary conditions at other times.

[**Fungicide injury and fungus control**], FISCHER (*Ber. K. Lehranst. Wein, Obst u. Gartenbau Geisenheim, 1913, pp. 13–18*).—This report deals with injury to grape leaves and shoots by the use of Bordeaux mixture, and with experiments testing the efficiency of three proprietary preparations designed to control Peronospora and Oïdium, and of a fourth preparation claimed by a vine grower to give satisfactory results against these fungi.

[**The use of fungicides against downy mildew**], E. RABATÉ (*Jour. Agr. Prat., n. ser., 28 (1915), Nos. 45, pp. 378, 379; 46, pp. 392, 393; 47, pp. 407, 408*).—This is a discussion of factors to be considered in connection with the control of downy mildew of grape, including the weather and similar conditions (temperature, humidity, precipitation, drainage, etc.), resistant varieties, developmental stages of the host and parasite, the time and number of fungicidal applications as related to weather and growth, and the forms, compositions, and adaptations of the fungicides recommended.

Treatment of grape downy mildew as related to the period of blooming (*Rev. Vit., 42 (1915), No. 1091, pp. 447, 448*).—The period during which mildew attack is most to be dreaded is said to be that during which the flowers are newly opened and their tissues are moist and tender. The great losses suffered in 1913 in portions of Algeria were due to an outbreak during this period of susceptibility.

It is claimed that the two sprayings to be given, one just before and one just after this period, should have a copper sulphate content of 2 per cent and should be neutral rather than acid. Another treatment should be applied at about the end of the flowering stage. Each of these treatments should be supplemented by application of the fungicide in the form of a powder, preferably at the time when moisture or dew is present in order to secure adherence to the plants.

Advance notices regarding mildew outbreak, J. CAPUS (*Rev. Vit., 42 (1915), No. 1092, pp. 461–463*).—This is a discussion of the conditions and indications of mildew outbreak, and previous notices regarding the same, referring to the 1910 records in this connection.

Grape chlorosis (*Rev. Vit., 42 (1915), No. 1092, pp. 471, 472*).—The humid weather of the past spring is said to have resulted in the appearance of chlorosis in severe form, especially in grape stocks on soil, the lime content of which is near the limit of tolerance.

The application of iron sulphate by way of wounds, while efficacious, is said to be impracticable as a general measure. A 0.4 per cent spray of iron sulphate may be repeated two or three times without injury, a greater strength burning the leaves. Treatment must be prompt in order to be effective. In case it is thought advisable to combine a fungicidal treatment with that for chlorosis, a solution containing 1.5 per cent of lime with 1 per cent each of copper sulphate and iron sulphate is prescribed.

Carefully chosen American stocks are said to be resistant to the influence of these limy soils.

Mildew of raspberry fruits, A. NAUMANN (*Sächs. Ztschr. Obst u. Gartenbau, 49 (1914), pp. 121–123; abs. in Mycol. Centbl., 5 (1915), No. 6, pp. 293, 294*).—A mildew observed on raspberry fruits in Dresden appears to be due to *Sphærotheca pannosa*.

The mopo disease of young cinchona plants and the Javanese seed bed fungus, A. RANT (*Bul. Jard. Bot. Buitenzorg, 2. ser., No. 18 (1915), pp. 22, pls. 7*).—The author describes the study of a fungus causing a seed bed disease of cinchona called mopo in Java. The organism is thought to be identical with *Moniliopsis aderholdii*. It is said to be common in Java and to be favored by close planting in seed beds and by stagnation and humidity of the air, but to be opposed by alkalinity of the soil.

A bibliography is appended.

Cottony rot of lemons in California, C. O. SMITH (*California Sta. Bul. 265 (1916), pp. 237–258, figs. 11*).—A description is given of the decay of lemons, commonly known as cottony rot or white mold, due to *Sclerotinia libertiana*. This disease is said to be widely distributed in the lemon-growing section of California and is characterized by a mass of white, cotton-like mycelial growth that rapidly spreads over the infected lemons. The affected tissue, while somewhat softer than normal, does not present the characteristics of a typical soft rot, as considerable firmness of the tissue may remain for some time. In advanced stages, however, the tissue becomes broken down and watery.

The life history of the fungus and the results of artificial inoculations are described. It has been found that the fungus attacks not only lemon fruit but the twigs of mature trees, nursery stock, and sweet and sour orange seed bed stock. The filaments of the fungus are able to enter and destroy a perfectly sound lemon at any point of contact, no abrasion being necessary. Attempts to inoculate the healthy, uninjured skin of a lemon with spores sprayed with an atomizer failed to give positive results except at the stem and blossom ends and rarely at points where two fruits were in contact. A study of strains of the fungus isolated from bean, cucumber, lettuce, vetch, wild lettuce, citrus

twigs, avocado twigs, tomato, and eggplant appears to indicate that these are identical with that causing the decay of lemon fruits described.

In a study of means for prevention of loss, disinfecting the fruits by the use of a wash water containing 0.02 per cent copper sulphate gave satisfactory results. Where this method is used, it is suggested that the wash water should be neutralized by the use of sulphuric acid before the copper sulphate is added to prevent the breaking down of the copper sulphate. Other important measures in controlling injury from this disease can be employed in the packing house, and the author recommends disinfection of storage boxes, frequent inspection, and the isolation of fruit that may have become infected by contact.

Die-back of lime trees in Montserrat (*Agr. News [Barbados], 14 (1915), No. 350, pp. 318, 319*).—Two fungi are said to be early and constantly present on diseased twigs of lime trees. One of these resembles the withertip fungus of citrus trees, *Colletotrichum glœosporioides*, as described by American writers, but the effects on leaves and fruits do not correspond so closely.

A Diplodia found on diseased branches is thought to be the same as that noted on cacao.

A disease of garden Arabis, R. LAUBERT (*Gartenflora, 63 (1914), No. 14, pp. 303, 304; abs. in Mycol. Centbl., 5 (1915), No. 6, p. 295*).—A disease of Arabis due to *Cystopus candidus* is reported at Berlin, this being supposedly its first appearance in Germany.

Rose mildew, KIESE (*Rosen Ztg., 29 (1914), p. 14; abs. in Mycol. Centbl., 5 (1915), No. 6, p. 298*).—Measures recommended as protective against rose mildew (*Sphærotheca pannosa*) are the selection of nonsusceptible varieties, avoidance of light sandy soils, and dusting several times during the early stages of growth with flowers of sulphur.

Control of rose mildew (*Ztschr. Obst u. Gartenbau, 40 (1914), No. 7, pp. 105, 106, figs. 3; abs. in Mycol. Centbl., 5 (1915), No. 6, p. 297*).—Brief discussion is given of machines for the employment of powdered sulphur for the control of rose mildew (*Sphærotheca pannosa*), with suggestions for the adaptation of the treatment to weather conditions.

Violet smut (Urocystis violæ), G. MÜLLER (*Prakt. Ratgeber Obst u. Gartenbau, 29 (1914), No. 7, p. 69, fig. 1; abs. in Mycol. Centbl., 5 (1915), No. 6, p. 296*).—In order to prevent the transmission of violet smut (*U. violæ*), which, it is said, may take place by means of cuttings, the use of seed only for propagation is recommended.

Recent observations on the blister rust of the Weymouth pine, C. von TUBEUF (*Naturw. Ztschr. Forst u. Landw., 12 (1914), No. 9–10, pp. 484–491*).—The author follows up a previous report (E. S. R., 31, p. 50) with the statement that in 1914 *Peridermium strobi* developed abundantly in spite of severe attacks thereon by *Tuberculina maxima*. Study of this relation was carried forward by Lechmere, whose report appears below.

A continuation of a previous study (E. S. R., 31, p. 451) on the Ribes generation of this fungus has shown that infection occurs very sparingly, if at all, on the upper leaf surfaces, which bear no stomata, or on the petioles. Infection of the lower leaf surfaces by the æcidiospores was not prevented by the application of Bordeaux mixture to the upper surfaces.

Discussion is given of collected observations regarding the host plants, overwintering, dispersal, and developmental conditions of this fungus.

Tuberculina maxima, a parasite on the blister rust fungus of the Weymouth pine, E. LECHMERE (*Naturw. Ztschr. Forst u. Landw., 12 (1914), No. 9–10, pp. 491–498, figs. 2*).—An account is given of a biological study of *T. maxima*. It is stated that only negative results were obtained from the study,

referred to above, regarding the possibility of checking blister rust (*Cronartium ribicolum* or *Peridermium strobi*) on pine by employing for this purpose its parasite, *T. maxima.*

The dry rot question, MOORMANN (*Gsndhts. Ingen., 38 (1915), No. 18, pp. 211–214*).—This is a reply to Falck on the same subject (E. S. R., 33, p. 151).

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Laws relating to fur-bearing animals, 1915, D. E. LANTZ (*U. S. Dept. Agr., Farmers' Bul. 706 (1916), pp. 24*).—A summary of laws in the United States and Canada relating to trapping, protection, propagation, and bounties.

Cottontail rabbits in relation to trees and farm crops, D. E. LANTZ (*U. S. Dept. Agr., Farmers' Bul. 702 (1916), pp. 12, figs. 5*).—A discussion of the damage caused by cottontail rabbits, and preventive and remedial measures therefor.

Further experiments on the effect of low temperatures on the frog, A. T. CAMERON (*Proc. and Trans. Roy. Soc. Canada, 3. ser., 8 (1915), Sec. IV, pp. 261–266*).—The data presented led the author to the following conclusions:

"The death temperature of *Rana pipiens* from cold is −1.25°±0.15° C. [29.75°±0.27° F.]. There is no climatic adaptation, nor any periodic adaptation due to hibernation, in *R. pipiens.* The cause of death is a specific temperature effect on the coordinating centers of the central nervous system. Those controlling lung respiration may be specially concerned. Frogs surviving degrees of cold such as those occurring during a Manitoban winter do so below the surface, near the margins of springs, and are themselves subjected to temperatures below the freezing point of water. There seems to be a slight variation in the death temperature from cold of different species of frogs, amounting to some tenths of a degree Centigrade. Frogs heated rapidly to normal room temperature from a temperature just below the freezing point of their body fluids (and not itself capable of causing death) are thrown into a peculiar hypersensitive condition, in which cessation of lung breathing takes place for long periods."

Snakes and their value to the agriculturist, R. W. SHUFELDT (*Sci. Amer. Sup., 80 (1915), Nos. 2082, pp. 344, 345, figs. 7; 2085, p. 393*).—Attention is called to the importance and value of snakes in the destruction of field mice. In a discussion of this paper which follows, W. H. McClellan reports field observations which indicate that the author's estimate of the number of mice consumed by a snake is much too high.

The cuticula of insects as a means of defence against parasites, W. R. THOMPSON (*Proc. Cambridge Phil. Soc., 18 (1915), No. 2, pp. 51–55*).—This is one of a series of papers reporting the results of studies of various biological questions connected with entomophagous parasites (E. S. R., 33, pp. 157, 855; 34, pp. 553, 557).

The interrelation of the phagocytes and parasites of arthropods, W. R. THOMPSON (*Bul. Soc. Zool. France, 40 (1915), No. 1–3, pp. 63–68, fig. 1*).—In continuation of the studies noted above the author presents the results of investigations of the phagocytic reaction in natural and experimental parasitism.

An improved collecting bottle, C. N. AINSLIE (*Psyche, 22 (1915), No. 6, pp. 211, 212*).

The calibration of the leakage meter, C. W. WOODWORTH (*California Sta. Bul. 264 (1916), pp. 231–234, fig. 1*).—It is pointed out that some leakage meters are so inaccurate that they are unsuitable for use as guides to dosage. The accuracy may be easily tested by measuring the clamp ring and the hole of the test plate. "Needles can be used to make test plates, making their meas-

urement unnecessary. The amount of the inaccuracy is determined by comparing the reading with a table. If found inaccurate the instrument should be returned to the maker for adjustment."

Thirtieth report of the state entomologist, 1914, E. P. FELT (*Univ. State N. Y. Bul. 606 (1916), pp. 336, pls. 19, figs. 101*).—In the first part of this report the author refers briefly to the work of the year and the more notable events. The injurious insects, next considered, include the lined red bug (*Lygidea mendax*), the species responsible for most of the red bug damage to apple orchards in the Hudson Valley; white grubs and May or June beetles; forest tent-caterpillar; brown tail moth, an infestation of which was found on Fishers Island, Gardiners Island, and the eastern end of Long Island; army worm; European pine shoot moth (*Evetria buoliana*) which has become established in several localities in New York State; box leaf midge (*Monarthropalpus buxi*), which has become thoroughly established on Long Island and is seriously injuring box hedges; and grasshoppers, a serious outbreak of which occurred on the sandy areas bordering the Adirondacks.

Under the heading of Notes for the Year (pp. 58–91) the author records observations on some of the more injurious or interesting species coming to notice. The fruit insects mentioned include the tent caterpillar; lime tree winter moth; green fruit worm; pear thrips; pear midge (*Contarinia pyrivora*); pear psylla; banded grape bug (*Paracalocoris scrupeus*), a description of the early stages of which are given; spotted winged Idiocerus (*Idiocerus maculipennis*); and San José scale. Several grass and garden insects are considered, namely, grass webworms (*Crambus luteolellus*); yellow field ant (*Solenopsis debilis*); Say's blister beetle (*Pomphopœa sayi*), unusually abundant and injurious in several localities in the State; juniper plant bug (*Chlorochroa uhleri*); and Iris borer (*Macronoctua onusta*). Those mentioned as having injured ornamental and shade trees are the European hornet (*Vespa crabro*), which attracted attention through its gnawing off the bark from the small branches of various trees, especially birch; the elm leaf beetle (*Galerucella luteola*); the gipsy moth, a colony of which was discovered at Mt. Kisco; Norway maple leafhopper (*Alebra albostriella*) and scurfy scale (*Leucaspis japonica*) on Norway maple, hitherto regarded as comparatively free from insect pests; pine leaf scale (*Chionaspis pinifoliæ*); spruce bud scale (*Physokermes piceæ*), which has become established in several widely separated districts of the State; the false maple scale (*Phenacoccus aceriçola*); and mulberry white fly (*Tetraleurodes mori*). The forest tree pests noted include the spruce bud moth (*Tortrix fumiferana*), ugly nest cherry worm (*Archips cerasivorana*), maple and oak twig pruner (*Elephidion villosum*), and periodical cicada. Several miscellaneous pests are also mentioned.

A list prepared by F. T. Hartman of the Coccidæ in the collection of the New York State Museum, consisting of 173 species of which 46 were found in New York, is next presented (pp. 92–109). This is followed by lists of publications of the entomologist and additions to the collections. Part 3 of A Study on Gall Midges, or Itonididæ (E. S. R., 33, p. 253), which deals with the tribes Porricondylariæ and Oligotrophiariæ and is illustrated by a number of plates, is appended.

[Entomological work in Porto Rico] (*Rpt. Bd. Comrs. Agr. P. R., 3 (1914), pp. 9–55*).—Several reports of work carried on in Porto Rico are presented, namely, Report of the Quarantine Inspection Work, by R. J. Fiske (pp. 14–19); Report of the Department of Entomology, by T. H. Jones (pp. 19–25); Report of the Traveling Entomologist, by G. N. Wolcott (pp. 25–40); Report of Work at the South Coast Laboratory, by E. G. Smyth (pp. 40–53); and Progress Report on Investigations Relative to the Horn Fly, by G. B. Merrill (pp. 53–55).

The report of the traveling entomologist considers details relating to the ork of collecting white-grub parasites (*Tiphia inornata* and tachinid species). a collecting material the author has found that the females of *Lachnosterna nplicata*, the most common species in Illinois, feed largely on the leaves of ottonwood and willow. Since they do not fly far after feeding before oviposit-g, large numbers of larvæ are most often found in fields near such trees.

An account is also presented of a trip to Cuba and Jamaica made during the inter of 1914 for the purpose of investigating sugar-cane insects and their nemies, especially the sugar-cane borer (*Diatræa saccharalis*) and the root orer (*Præpodes vittatus*). The author found the sugar-cane borer apparently ss common in Cuba than in Porto Rico and Louisiana. A tachinid fly (*Tachi-ophyto* [*Hypostena*] sp.) was found to be the most important larval parasite f *D. saccharalis* in Cuba. It was found abundant in nearly every field in hich the borer was present, and it is estimated that 25 per cent of the borer arvæ in Cuba, half grown or larger, are parasitized by this tachinid. A imilar species occurs in Jamaica. Several predaceous larvæ of an elaterid eetle were found in the borer tunnels at Chaparra. Other important insect nemies of cane observed in Cuba are the mealy bug (*Pseudococcus* sp.), *Solc-opsis geminata*, the weevil stalk borer (*Metamasius sericeus*), the West Indian ugar-cane leafhopper (*Delphas saccharivora*), and the root borer *Diaprepes bbreviatus*.

In Jamaica it was found that the root borer *P. vittatus*, previously an impor-nt sugar-cane pest, but which is parasitized by *Elis atrata*, has not been undant in recent years. The fact that the sugar-cane borer is generally less undant in Cuba and Jamaica than in Porto Rico and Louisiana is due in part o parasitism by tachinid flies, the general practice of not burning trash which avors the effectiveness of the egg parasite *Trichogramma minutum*, care in lanting seed free from Diatræa larvæ, and sanitation in harvesting cane, hat is, cutting close to the ground and destruction of injured stalks.

The report of work at the south coast laboratory deals with the injury by eetles and by white grubs, species responsible for injury, injury by other carabæids, field habits of Lachnosterna, laboratory work with Lachnosterna nd related Scarabæidæ, control of white grubs, and release of parasites in Porto Rico.

[Report of the] division of entomology and zoology (*Washington Sta. Bul.* 27 (*1915*), *pp. 30–38, figs. 2*).—The investigations in Washington State have hown that differences in the viability of scale insects are not due so much to he strength of the spray employed as to the locality where the spraying is one. There was found to be a much greater difference in the effect produced y a single spray at Wenatchee and Clarkston than between the effect of an xcessively strong spray as compared with an excessively weak spray used at ther place alone. See also a previous note by Melander (E. S. R., 34, p. 551). It is stated that the Colorado potato beetle has now become acclimated to onditions in eastern Washington and is proving to be as destructive there as sewhere. Brief reference is made to the study of endoparasites of the cabbage phis and other insects, and brief reports are given of the work with root mag-ots and the Columbian ground squirrel. The data secured in investigations ave shown beyond doubt that there is but one brood per year of the Colum-ian ground squirrel, and for this locality the litter appears above the surface bout the first to the tenth of May.

[Report of entomological work], J. S. Dash (*Rpt. Dept. Agr. Barbados, 913–14, pp. 37–43*).—The author reports upon the occurrence of the more im-ortant insects of the year in Barbados and work therewith.

[Summary of investigations of the division of entomology], D. D'EMMEREZ DE CHARMOY (In *Summary of Investigations Made During the Period January 1 to June 30, 1915. Mauritius: Dept. Agr., 1915, pp. 3–7*).—A brief report of the occurrence of and work with the more important insects in Mauritius.

Cassava insects, F. W. UBICH (*Bul. Dept. Agr. Trinidad and Tobago, 14 (1915), No. 2, pp. 38–40*).—The author calls attention to some of the insects found on cassava in Trinidad and Tobago which may become pests.

Insects injurious to stored grains in Mauritius, D. D'EMMEREZ DE CHARMOY (*Dept. Agr. Mauritius, Sci. Ser., Bul. 2 (1915), [English Ed.], pp. 16, pls. 3*).—Brief accounts are given of three insects attacking maize, namely, the rice weevil, the maize beetle or bamboo borer (*Didoncrus minutus*), and the maize tinetid; two attacking rice, the rice weevil and rice moth (*Ephestia cahiritella*); three attacking the seeds of leguminous plants, the bean weevil, cowpea weevil, and four-spotted weevil (*Bruchus quadrimaculatus*); and three attacking bran, flour, and other foodstuffs, namely, the saw-toothed grain beetles (*Sylvanus signatus* and *S. surinamensis*) and the flour beetle (*Tribolium ferrugineum*).

Insect-borne diseases in Pan-America, J. GUITERAS (*Havana: Dept. Health and Charities Republic Cuba, 1915, pp. 42, pl. 1, figs. 2*).—This paper, read before the Second Pan-American Scientific Congress, held in Washington, D. C., December 27, 1915, to January 8, 1916, reviews the subject at some length and presents a classified bibliography of 156 titles.

Termites, or "white ants," in the United States: Their damage and methods of prevention, T. E. SNYDER (*U. S. Dept. Agr. Bul. 333 (1916), pp. 32, pls. 15, figs. 5*).—A general account of termites, particularly *Leucotermes flavipes*, *L. virginicus*, and *L. lucifugus*, their life history and bionomics, geographical distribution, economic importance in the United States, and preventive and remedial measures.

The apple red bugs (Heterocordylus malinus and Lygidea mendax), C. R. CROSBY (*New York Cornell Sta. Bul. 291, rev. ed. (1915), pp. 213–230, figs. 28*).—A revised edition of the bulletin previously noted (E. S. R., 25, p. 255).

A serious attack of Jassus sexnotatus on autumn rye, in the autumn of 1914, H. VON FEILITZEN (*Landtmannen, 26 (1915), No. 19, pp. 169–172, figs. 4; abs. in Rev. Appl. Ent., 3 (1915), Ser. A, No. 9, pp. 525, 526*).—An outbreak of this pest in a field of fall rye at Jönköping, Sweden, is reported, this being the first record of its injury to the crop in Sweden.

Life history of Vanduzea arquata, W. D. FUNKHOUSER (*Psyche, 22 (1915), No. 6, pp. 184–198, pl. 1*).—The life history studies of this membracid, one of the most widely distributed in the United States, are based upon field notes made during the past five summers in the vicinity of Ithaca, N. Y., where the species is very abundant upon the locust (*Robinia pseudacacia*).

The periodical cicada in Missouri, L. HASEMAN (*Missouri Sta. Bul. 137 (1915), pp. 3–33, figs. 27*).—A general account of its life history and bionomics, followed by an illustrated discussion of the distribution of broods of periodical cicada in Missouri.

Morphology and biology of the green apple aphis, A. C. BAKER and W. F. TURNER (*U. S. Dept. Agr., Jour. Agr. Research, 5 (1916), No. 21, pp. 955–994, pls. 10, figs. 3*).—The authors report in detail upon studies of the life history of *Aphis pomi* which were commenced in 1913 and carried on at Vienna, Va. The outline of the life history prepared by the authors is as follows:

"The egg is laid upon the tender twigs of the apple, though occasionally it is laid upon the bark of the older twigs. It is light yellow when laid, but later changes to shining black. Development for a few days is very rapid, after which the egg rests for the winter. When the revolution of the embryo is completed in the spring, an increase in temperature will cause the egg to hatch.

efore this revolution a high temperature only tends to destroy it. Early in pril the egg hatches by a uniform splitting over the insect's head.

"The stem mother is wingless and becomes mature in about ten days. She roduces summer forms, both winged and wingless, with the winged ones preominating. There are 9 to 17 generations of the summer forms at Vienna, a. After the second generation the wingless forms always outnumber the thers, but winged forms may occur in every generation. They become rare oward the end of the season. On the other hand, a wingless line may be carried from the stem mother to the egg. A third form, the intermediate, may ccur throughout the summer. The wingless sexes begin to appear about the irst of September. They occur in all generations, from the eleventh to the ineteenth, inclusive, and probably also in the ninth and tenth. The summer ringless forms and the oviparous females, which live longer than the males, emain on the trees at Vienna, Va., until the leaves drop, usually about the iddle to the last of November.

"Mating commences toward the close of September, one male usually serving nore than one female. Both sexes feed. The oviparous female may lay inertile eggs if not reached by a male, and these eggs do not become black. The ertile egg develops to the resting stage before the first heavy frosts; otherwise t may be winterkilled and will not hatch to a stem mother the following pring."

A genealogical diagram which accompanies the paper shows the forms and enerations developing from one stem mother of the green apple aphis as indiated by the authors' breeding experiments.

Experiments with sprays against Aphis papaveris, Sofie Rostrup (*Tidsskr. Planteavl, 22 (1915), No. 2, pp. 233-256; abs. in Rev. Appl. Ent., 3 (1915), Ser. A, No. 9, pp. 526, 527*).—Experiments with nicotin sprays for the control of *A. umicis (papaveris)* on seed turnips and horse beans conducted in 1913-14 howed 0.1 per cent nicotin to be sufficient, and when the attack is not serious ven less may be used, although 0.05 per cent is probably too weak. "*Macrosihum (Siphonophora) pisi*, a large species often occurring in company with *A. umicis*, is more resistant to the spray. Coccinellidæ in all stages, *Sitones lineatus*, and thrips were found alive on the plants, whereas *Lygus campestris* as killed."

The leopard moth: A dangerous imported insect enemy of shade trees, L. O. Howard and F. H. Chittenden (*U. S. Dept. Agr., Farmers' Bul. 708 (1916), pp. 16, figs. 4*).—A revision of Bureau of Entomology Circular 109, previously noted (E. S. R., 21, p. 458).

The catalpa sphinx, L. O. Howard and F. H. Chittenden (*U. S. Dept. Agr., Farmers' Bul. 705 (1916), pp. 9, figs. 5*).—A revision of Circular 96 of the Bureau of Entomology, previously noted (E. S. R., 19, p. 759).

The fruit-tree leaf roller (Archips argyrospila), G. W. Herrick and R. W. Leiby (*New York Cornell Sta. Bul. 367 (1915), pp. 247-279, figs. 18*).—In addition to the data presented in Bulletin 311 (E. S. R., 27, p. 160) and in a paper (E. S. R., 34, p. 63) previously noted, the authors report control experiments carried on from 1911 to 1914.

The experiments have shown that the eggs of the leaf roller are susceptible to the effect of miscible oils, which, when thoroughly applied, have destroyed from 74 to 92 per cent. "In experiments made during the last three years no injury has resulted from the use of miscible oils. The oils have been applied in the spring (April) at as near the active growing period of the tree as possible, but always before the buds burst. They have been used generally at the

rate of 1 gal. to 15 gal. of water. Only one application should be made, and that on a day when the temperature is above freezing.

"In cases of severe infestation the oils should be supplemented by thorough sprayings with arsenate of lead at the rate of 6 lbs. to 100 gal. of water or of lime-sulphur solution. At least one application should be made before the blossoms open, and another after the petals fall; the latter will serve also as the regular spraying for codling moth. In lightly infested orchards spraying with miscible oils may be omitted and reliance placed on thorough applications of arsenate of lead, at the rate of 6 lbs. to 100 gal. of water or lime-sulphur solution. One or two applications should be made before the blossoms open and another after the petals fall."

The bagworm, an injurious shade tree insect, L. O. HOWARD and F. H. CHITTENDEN (*U. S. Dept. Agr., Farmers' Bul. 701 (1916), pp. 11, figs. 13*).—A revision of Circular 97 of the Bureau of Entomology, previously noted (E. S. R., 19, p. 860).

The cranberry girdler and its control, H. B. SCAMMELL (*Proc. Amer. Cranberry Growers' Assoc., 46 (1915), pp. 4–6*).—The observations of the season are said to have led to the conclusion that there is only one annual brood of the cranberry girdler (*Crambus hortellus*).

Observations on respiration of Culicidæ, S. K. SEN (*Indian Jour. Med. Research, 2 (1915), No. 3, pp. 681–697, pls. 4, figs. 4*).—A report of observations on the consumption of oxygen and evolution of carbon dioxid by mosquitoes.

Notes on five North American buffalo gnats of the genus Simulium, A. W. JOBBINS-POMEROY (*U. S. Dept. Agr. Bul. 329 (1916), pp. 48, pls. 5, figs. 15*).—Morphological and biological studies are here presented. The various stages of the simulids, their life cycle and number of generations, insect enemies and parasites are dealt with. The Simulium as a possible carrier of disease is also considered.

A bibliography of 14 pages arranged in alphabetical order is appended.

Sarcophagid larvæ from the painted turtle, F. E. CHIDESTER (*Jour. Parasitology, 2 (1915), No. 1, pp. 48, 49, figs. 2*).—The author records having reared several sarcophagid larvæ from the painted turtle (*Chrysemys picta*) at New Brunswick, N. J.

A new generic name for the screw worm fly, C. H. T. TOWNSEND (*Jour. Wash. Acad. Sci., 5 (1915), No. 20, pp. 644–646*).—The author erects the genus Cochliomyia for the screw worm fly, which has been known as *Chrysomyia macellaria*.

Life history studies of the Colorado potato beetle, PAULINE M. JOHNSON and ANITA M. BALLINGER (*U. S. Dept. Agr., Jour. Agr. Research, 5 (1916), No. 20, pp. 917–926, pl. 1*).—This is a report of experiments conducted in the District of Columbia during the season of 1914, during which time the temperature was exceedingly high with more than the normal rate of humidity. The data are presented largely in tabular form under the headings of generation experiments, number of molts and duration of instars, and fall mating for spring egg laying.

Observations on the life history of the cherry leaf beetle, G. W. HERRICK and R. MATHESON (*U. S. Dept. Agr., Jour. Agr. Research, 5 (1916), No. 20, pp. 943–950, pls. 2*).—The authors report from the New York Cornell Experiment Station that several severe outbreaks of the cherry-leaf beetle (*Galerucella cavicollis*) occurred in New York State during the summer of 1915, in which the adult beetles defoliated cherry, peach (*Amygdalus persica*), and plum. Practically all the injury was restricted to the western and southwestern part of the State.

In the present paper they first present a historical review, after which the life history and habits are briefly dealt with. This beetle is widely distributed,

occurring from Canada, through the New England States southward into Pennsylvania, and west to Wisconsin. It is also said to have been recorded from Texas and Vancouver, British Columbia, while the original specimen was described from North Carolina. In New York State there is only a single brood each season, the new brood of adults appearing during the second week in August and becoming common during the latter part of the month and early September. At Ithaca oviposition takes place from June to August. The larvæ, which hatch out in from 14 to 18 days, make their way from the branches to the young and tender foliage near the tips of the twigs, where they feed ravenously and reach maturity in from two to three weeks. Where the larvæ are abundant all the foliage may be so completely skeletonized as to turn brown and die, giving the trees a scorched appearance. A close examination about Ithaca failed to detect the presence of larvæ on any trees but the pin cherry. Pupation is said to take place at or slightly below the surface of the soil.

Due to scarcity of material, control experiments have not been conducted by the authors, but correspondents have reported good success from the use of arsenate of lead paste at the rate of 4 to 5 lbs. to 100 gal. of water and also from a spray containing 40 per cent of nicotin.

The tobacco wireworm, C. Bencomo (*El Pasador del Tabaco. Port au Prince, Haiti: Author, 1915, pp. 13, pl. 1; abs. in Rev. Appl. Ent., 3 (1915), Ser. A, No. 9, p. 525*).—*Agriotes* (*Elater*) *segetis*, known as an enemy of cereals and vegetables, attacks the roots of the tobacco plant in Cuba, where it is termed the tobacco wireworm. The present paper gives a brief account of its life history and control measures.

The corn stalk beetle, R. W. Harned (*Mississippi Agr. Col. Ext. Serv. Press Circ., 1915, June 19, folio.*)—The author reports complaints from many parts of Mississippi of injury to corn by the corn stalk or sugar cane beetle (*Ligyrus rugiceps*), an account of which by Titus (E. S. R., 17, p. 781) has been noted. It is pointed out that while it does some damage every year, it was apparently much worse during the spring of 1915 than during any previous year of which there is record, with the possible exception of 1904, as reported by Herrick (E. S. R., 17, p. 265). Several remedial practices are recommended.

The effect of cyanid on the locust borer and the locust tree, W. P. Flint (*Science, n. ser., 42 (1915), No. 1090, pp. 726, 727*).—The author, from the Illinois state entomologist's office, reports experiments carried on in central and northwestern Illinois early in the spring in which from 0.05 to 0.5 oz. of 98 per cent potassium cyanid and of cyanid-chlorid carbonate mixture (guaranteed to contain from 35 to 38 per cent sodium cyanid) was introduced into 50 black locust trees of from 1 to 7 in. in diameter. The cyanid was inserted in the trees in auger holes of 0.25, 0.5, 0.75, and 1 in. in diameter, bored at different heights from the ground and different depths into the trunk.

Of 42 trees located in July, 23 were dead and 19 alive, all but 3 of the latter being infested with living larvæ of *Cyllene robiniæ*. "In several cases living borers were found directly above and within 6 in. of the auger holes, and in 3 cases the borers were within 1 in. of the auger holes. Not only were the borers alive in the living trees, but in all cases where the trees had put forth leaves in the spring of 1915 living borers were present in numbers in the trunks, and could be found around the bases of the trunks of many of the trees that had not shown foliage the past spring. Not a single dead borer was found near the points where the cyanid had been placed.

"While over half of the trees treated were dead, this was not entirely due to the effects of the cyanid, as at least 25 per cent of the untreated trees in both groves had died from the effects of borer injuries. There can be no doubt, however, that the cyanid had a very injurious effect on the trees, as in all the

living trees the bark was dead and the wood discolored for a greater or less distance around the holes where the cyanid had been placed."

Farm beekeeping, E. E. TYLER and L. HASEMAN (*Missouri Sta. Bul. 138 (1915), pp. 3–40, figs. 20*).—This is a general account of the honeybee and bee keeping. Receipts for the use of honey are included.

The olfactory sense of the honeybee, N. E. MCINDOO (*Jour. Expt. Zool., 16 (1914), No. 3, pp. 265–346, figs. 24*).—In the investigation here reported the author had two objects in view: (1) The determination of the relative sensitiveness of the honeybee to different odors, so that it may be expressed numerically for comparison under different conditions; and (2) the location of the olfactory organs. Experiments were conducted with normal bees and mutilated bees in observation cases, and a study was made of the morphology of the olfactory pores.

"Bees have a very acute sense of smell. This sense is most highly developed in the drones and least developed in the queen, while that of the worker is scarcely inferior to that of the drone. Olfactory pores are found on the bases of all four wings, widely scattered on the trochanter and at the proximal ends of the femur and tibia of all six legs, on the second and third tarsal joints of most legs, and generally distributed on the shaft and lancets of the sting. Each pore is a chitinous structure connected with a bipolar sense cell, the peripheral end of which comes into direct contact with the external air. Such sense cells are met with in all insects, for Künckel and Gazagnaire (1881) assert that bipolar sense cells are common to all insects."

Parasitism among the larvæ of the Mediterranean fruit fly (Ceratitis capitata) in Hawaii during 1914, E. A. BACK and C. E. PEMBERTON ([*Bien.*] *Rpt. Bd. Comrs. Agr. and Forestry Hawaii, 1913–14, pp. 153–161*).—This paper includes tabular data on the rearing of parasites from coffee (see E. S. R. 32, p. 757), Chinese oranges, and strawberry guava. The authors found a parasitism of from 29 to 53.8 per cent among pupæ from the strawberry guava (*Psidium cattleyanum*) in Honolulu in July, 1914. *Opius humilis*, introduced from South Africa and first liberated on the island of Oahu in November and December, 1913, appears to be largely responsible for the noticeable decrease of the fruit fly.

On some genera of the pimpline Ichneumonidæ, J. H. MERRILL (*Trans. Amer. Ent. Soc., 41 (1915), No. 2, pp. 109–154, pls. 3*).—A systematic study of the genera Megarhyssa, Rhyssa, Apechoneura, and Pseudorhyssa with 14 species. One genus and species, *Pseudorhyssa sternata*, are described as new to science.

Sugar cane borer parasites and control of borers, P. VAN DER GOOT (*Meded. Proefstat. Java-Suikerindus., 5 (1915), No. 4, 125–176, pls. 3; abs. in Rev. Appl. Ent., 3 (1915), Ser. A, No. 7, pp. 382–386*).—In Java the borers are the most important enemies of sugar cane. In the present paper four species, namely, the striped stalk borer (*Diatræa striatalis*), the yellow tip borer (*Chilo infuscatellus*), the white tip borer (*Scirpophaga intacta*), and the gray borer (*Olethreutes* [*Grapholitha*] *schistaceana*), and their parasites are dealt with at length.

A list of Tenthredinidæ collected in the Luga district of the Government of Petrograd and some biological observations on them, V. PADALKA (*Russ. Ent. Obozr., 14 (1915), No. 4, pp. 460–472; abs. in Rev. Appl. Ent., 3 (1915), Ser. A, No. 7, p. 389*).—A list is given of 108 species of Tenthredinidæ and 5 of Lydidæ collected near Luga, in the Government of Petrograd, together with host plants and a more or less full account of their life histories.

Two strawberry slugs, R. L. WEBSTER (*Iowa Sta. Bul. 162 (1915), pp. 3–20, figs. 11; popular ed., pp. 4, figs. 3*).—The early strawberry slug (*Empria fragariæ*) and the late strawberry slug (*E. maculata*) are here considered, the first having

at times been abundant and very destructive in Iowa. Both of these slugs in their older satges cause similar injury to strawberry through eating out more or less irregular holes in the foliage, often leaving it ragged and with little more than the midrib and some of the larger veins untouched. Besides the holes in the leaves, damaged foliage has frequently a browned and dried appearance, due to the work of the young slugs, which at first eat only the outer part and not clear through the leaves. When first hatched the early strawberry slugs begin to feed on the upper surface of the leaves. The newly hatched slugs of the later species begin their feeding on the lower leaf surface.

Brief accounts are given of both species, including their past history, classification, generations, several stages, and natural enemies.

"An application of lead arsenate paste, at the rate of 2 lbs. in 50 gal. of water (or powdered lead arsenate, 1 lb. in 50 gal.), put on immediately before blossoming, will control the early strawberry slug. Powdered zinc arsenite, 1 lb. to 100 gal. of water is also effective. . . . Should the late strawberry slugs become destructive, an application of hellebore would probably check them, this applied at the rate of 1 lb. in 50 gal. of water."

FOODS—HUMAN NUTRITION.

Chemical and physical constants for wheat and mill products, E. F. Ladd (*North Dakota Sta. Bul. 114 (1916), pp. 272–297, figs. 9*).—This bulletin summarizes a large amount of experimental data regarding the varieties of wheat grown in the State and the climatic and soil influences on their milling and baking value. About 660 complete trials were made with North Dakota grown wheat during the period 1907–1914.

The average amount of screenings found in 652 samples of wheat was 3.99 per cent, but 83 of the samples examined contained more than 30 per cent. These screenings consisted chiefly of shrunken and broken particles of wheat, dirt, weed seed, wild oats, etc., and according to the analyses reported constitute a valuable stock feed.

The average loss in milling in 665 trials, representing all classes and grades of wheat, was 2.24 per cent. Six hundred and sixty-one samples of wheat of all grades showed an average flour production of 68.82 per cent, and of these samples 210 gave a yield of 70 per cent or better. The bran contained in 649 samples amounted to 12.71 per cent on an average, and the amount of shorts in 651 samples 15.15 per cent.

Baking tests with 646 samples of flour produced from all classes and varieties of wheat showed the average loaf volume to be 2,343 cc.

Milling tests were made to determine the yields of flour, bran, and shorts for the different varieties and grades of wheat by years. These showed that "in general the percentage of flour produced from the several brands follows the same general curve; that is, the variation in the percentage of flour seems to be due more largely to climatic or seasonal differences than to variety differences. The diagram for the percentage of flour produced for the several varieties clearly indicates this. In general, Velvet Chaff produced a lower percentage of flour than any of the varieties, although at the same time it produced the maximum percentage. There is very little difference between the Fife and Bluestem, and it is interesting to note that for the period of 8 years durum wheat has averaged only slightly lower in percentage of flour than the other varieties."

Data are given regarding the moisture in the wheat before and after tempering and also in the flour; the protein in the wheat by grades and years and in the flour; color scores; the absorption of water; baking tests; and wheat and flour prices. As regards bread-producing qualities, "more than 650 tests, divided among the several varieties of wheat and for the different grades of each

variety, did not show any very marked variation in loaf volume for the different grades. As a whole, the Bluestem averaged slightly higher in loaf volume than either of the others. Velvet Chaff was equal to the Fife, while durum fell considerably below. The color and texture of all were good. The mean for all the tests of each variety furnishes a fair basis for comparison."

Analyses of wheats and flours, J. C. BRUNNICH (*Ann. Rpt. Dept. Agr. and Stock [Queensland], 1914–15, pp. 54–61*).—Data are given regarding the composition of a large number of samples of wheat and flour, the appearance of the grain and gluten being included.

The digestibility of bran, M. HINDHEDE (*Skand. Arch. Physiol., 33 (1915), No. 1–3, pp. 59–80; abs. in Zentbl. Physiol., 30 (1915), No. 12, p. 561*).—In the author's opinion, the nutritive value of bran is such that it is a mistake to use it in times of need for animal feeding.

Do present practices in bread making conform with the biochemical teachings of human nutrition? J. STOKLASA (*Deut. Med. Wchnschr., 42 (1916), No. 3, pp. 75–77*).—The author compares the chemical composition and nutritive values of pure rye bread, bread made from 80 per cent of rye flour and 20 per cent of specially prepared bran, and bread containing 70 per cent rye flour and 30 per cent bran.

Digestion experiments in vitro indicated that the protein in bread made with 30 per cent bran was as thoroughly digested as that of the pure rye bread. It is the opinion of the author that bran, which is rich in protein and organic phosphorus compounds, should be milled in such a way as to make these food constituents available to the body and incorporated in all flour used for bread making.

The bacterial examination of sausages and its sanitary significance, W. E. CARY (*Amer. Jour. Pub. Health, 6 (1916), No. 2, pp. 124–135*).—The significance of the bacterial content of sausages is discussed in the light of work of other investigators, mostly German and French.

The investigation here reported was carried out to determine the number of bacteria present and the factors influencing it; the prevalence of fecal or pathogenic organisms; the presence of adulterants and preservatives; and the influence of sanitary marketing and of cooking on the bacterial content. Thirty-four samples of sausage, purchased under the usual conditions found in the markets of Chicago, were examined; at the time of purchase each market was scored on the sanitary surroundings, method of handling and exposure of the meat, general cleanliness, and facilities for refrigeration. Determinations were made of the total numbers of bacteria per gram of meat, developing at 37° C. in 24 hours and at 20° in 48 hours, and also of the numbers of *Bacillus coli* and organisms forming gas with dextrose.

From the results of these tests, which are reported in detail, the author concludes that "the number of bacteria per gram of sausage varies so widely that little importance can be attached to the bacterial count alone. Many factors, such as the precautions used in manufacture, proper handling in the shops, and the presence of preservatives may influence the count greatly."

The following organisms, among others, were isolated from the 34 samples examined: *B. coli*, 30 times; *Proteus vulgaris*, 11 times; *B. paracoli* (organism resembling *B. paratyphosus* morphologically and culturally but not agglutinated by either paratyphoid of enteritidis serum), 9 times; *B. fecalis*, 8 times; yeast, 8 times; Streptococcus, 5 times; and *Staphylococcus aureus*, 2 times.

Each of the samples was examined for starch adulteration. Cornstarch was very commonly used in a very finely ground condition. It was present in 56 per cent of all samples, and in 26 per cent of the samples 5 per cent or over was found. It was noted that starch was present in 77 per cent of the samples pur-

chased in the poorer districts, and in only 38 per cent of the samples from the more sanitary shops, and that the price per pound in these districts was 13 to 15 cents and 18 to 25 cents, respectively.

In an attempt to determine the influence of sausage casings on the bacterial content the scrapings from the interior of the casings from 7 samples were examined in parallel with the interior contents of the same sausage. As a result of this test the conclusion is drawn that "skins used as casings, if properly prepared, can not be considered to increase the bacterial count or the danger from pathogens."

Sulphites were found in 7 of the 13 samples tested for the presence of this preservative.

Six samples of pork sausage were cooked in various ways in the laboratory to determine the effect of household methods of cookery upon the bacterial content. Four samples of sausage cooked in restaurants were also examined bacteriologically as an index of the efficiency of ordinary restaurant cooking. It was found in general that cooking destroyed a very large percentage of the bacteria, and that extra well-cooked sausages were sterile. The efficiency of cooking varied only within the limits of 93.3 per cent and 100 per cent.

The composition and evaluation of boullion cubes, G. KAPPELLER and A. GOTTFRIED (*Ztschr. Untersuch. Nahr. u. Genussmtl., 31 (1916), No. 1, pp. 1–6*).—Analytical data are reported showing the composition of 35 samples of boullion cubes. The following variations in percentage composition were noted: Water, 10.0–1.1; protein, 26.9–0.43; phosphoric acid, 1.43–0.25; ash, 83.7–56.85; sodium chlorid, 83.3–53.7; total creatinin, 1.2–0.0; fat, 9.6–0.0; and sugar, 14.7–0.0 per cent.

Mushrooms as food, W. BRUHN (*Gartenflora, 64 (1915), No. 21–22, pp. 353–364, figs. 3*).—Analytical data are given comparing the composition of mushrooms with that of many more common foods.

Poisoning by mushrooms, S. CHAUVET (*Les Empoisonnements par les Champignons. Paris: Le François, 1915, pp. 59, pls. 4, figs. 2*).—The author brings together in this book information concerning the causes of occasional poisoning by fungi, and the diagnosis and treatment of such cases. The botanical characteristics of some very poisonous varieties of mushrooms are described in detail.

[Food and drug inspection and analysis], R. M. ALLEN (*Kentucky Sta. Food and Drugs Bien. Rpt., 8 (1913–1915), pp. 1–12, 26–44*).—This is a report of the work done under the state food and drugs act during the biennium ended June 30, 1915, which included the analysis of 11,095 samples of foods and drugs, a bacteriological study in cooperation with the Bureau of Chemistry of the U. S. Department of Agriculture as to the packing, shipment, and sale of oysters, an extensive sanitary survey of the establishments in the State engaged in the slaughtering of cattle and the packing of meat, a study of eggs sold on the market, and, in connection with the research work of the experimental bakery, tests of the effects of a variety of different substances upon the quality of the bread.

From a study made of the effect of wrapping upon the quality of the loaf, the following conclusions are drawn: The chemical change is slight or none at all for the different substances in the loaf for a limited time so more can be deducted from the physical appearance, taste, odor, etc. The paraffin paper causes bread to retain all its moisture, which becomes equally distributed even into the crust, destroys its stiffness and renders it less desirable for use. From bread wrapped in porous paper, one secures all sanitary benefits without injury to the loaf. Unwrapped bread is insanitary if exposed, and is liable to the growth of mold. Wrapping in porous paper seems to be the most desirable method."

The possibility of using cotton-seed flour in bread making was studied to some extent. "Cotton-seed flour stimulated fermentation. It caused decrease in loaf volume by weakening or diluting the gluten of the wheat flour. When more than 75 gm. of cotton-seed flour is added the gluten is so weakened that sufficient rise for baking can not be secured. The color resembles that of ginger bread when as much as 20 per cent of cotton-seed flour is added. The loaf has a rich, nutty flavor, that is highly pleasing, and it is the opinion of those who have tried it that the flavor is an improvement over the straight wheat flour."

In connection with the work of the food laboratory, attention was given to the extent and means of preventing food spoilage. This was found to be due mainly to imperfect methods of the producer in picking, packing, and grading; inadequate storage and shipment facilities; improper conditions of storage; and a lack of compliance with general sanitary principles.

[Food and drug analysis], R. E. Rose and L. Heimburger (*Fla. Quart. Bul. Dept. Agr., 26 (1915), No. 1, pp. 8–11, 132–145*).—As a part of the report of the state chemist for 1915, data are given regarding the examination of 375 samples of food and drug products, including 304 samples of citrus fruits.

Report of the agricultural-experiment and food-investigation station at Klagenfurt for the year 1914, H. Svoboda (*Ztschr. Landw. Versuchsw. Oesterr., 18 (1915), No. 6, pp. 357–369*).—The results are herein recorded of the investigation of 1,053 miscellaneous foods and beverages.

Undergraduate budgets, Ada L. Comstock (*Smith Alumnæ Quart., 7 (1916), No. 2, pp. 81–86*).—This article reports the results of a study of the budgets of 421 students in Smith College during the school year 1914–15.

Foodstuffs, D. Sommerville (*Jour. Roy. Soc. Arts, 63 (1915), Nos. 3277, pp. 893–903; 3278, pp. 909–921; 3279, pp. 925–932; 3280, pp. 937–943*).—In this series of four lectures the author reviews the principles of food and nutrition in the light of recent investigations.

Nutrition, T. B. Osborne and L. B. Mendel (*Carnegie Inst. Washington Year Book, 14 (1915), pp. 378–384*).—This article summarizes the results of investigations of the vegetable proteins, carried out for the Carnegie Nutrition Laboratory. Most of the material here presented has been noted from other sources.

Nitrogen economy by means of adding ammoniacal salts and urea to the diet, E. Grafe (*Deut. Arch. Klin. Med., 117 (1915), No. 4–5, pp. 448–461; abs. in Zentbl. Physiol., 30 [1915], No 11, pp. 489, 490*).—A number of instances are reported in which the addition of ammonium chlorid, ammonium citrate, urea, or a combination of these to the diet produced a considerable improvement of the nitrogen balance, which could not be obtained from an ordinary standard diet.

The influence of carbohydrate and fat on protein metabolism with special reference to the output of sulphur, K. Tsuji (*Biochem. Jour., 9 (1915), No. 4, pp. 439–448*).—To determine the effect of diets rich in fat and correspondingly poor in carbohydrate, or vice versa, on protein metabolism as measured by the excretion of sulphur in the urine, feeding experiments were conducted with a laboratory animal (dog). The data of three experiments are summarized in part as follows:

The retention of superimposed nitrogen was greater on a carbohydrate than on a fat diet; in two of the experiments the same was true for sulphur.

"The amount of extra nitrogen and sulphur excreted varies with the protein used. There is no evidence that the protein retained after superimposition is poor in sulphur. Indeed, with the exception of one experiment, sulphur is definitely retained in larger amount than nitrogen."

The influence of fat and carbohydrate on the excretion of endogenous urins in the urine of dog and man, N. UMEDA (*Biochem. Jour., 9 (1915), No pp. 421–438*).—In feeding experiments in which the author served as subject, ets containing varying proportions of protein, fat, and carbohydrate, but urin-free, were consumed in an attempt to get further information concerning e synthesis of uric acid in the human body.

The conclusions drawn are in part as follows: The protein-sparing action of rbohydrate as compared with fat is clearly demonstrated. In the case of an there is some evidence of the synthetic formation of uric acid when the iet is rich in carbohydrate. In fat-rich diets which are carbohydrate-poor ie output of uric acid is markedly diminished.

The influence of the diet, especially of carbohydrates, on the secretion of ie urine of infants, A. NIEMANN (*Jahrb. Kinderheilk., 82 (1915), No. 1, pp. 21–; abs. in Zentbl. Physiol., 30 [1915], No. 11, p. 488*).—Instances are described which normal infants accustomed to a milk diet were given an addition of om 40 to 50 gm. of carbohydrate daily. The amount of urine excreted was onsiderably increased, and at the same time a gain in weight was noted. The uthor concludes that the hydrolytic cleavage of di- and polysaccharids produces a storing up of glycogen, which is responsible for these results.

The cultivation of fat-containing organisms. (A present and future roblem), LINDNER (*Umschau, 19 (1915) No. 52, pp. 1027–1032, figs. 5*).—Descriptions are given of a number of organisms which have the property of onverting the carbohydrate of the culture medium into fat.

Studies on water drinking.—XVIII, On the relation between water ingestion and the ammonia, phosphate, chlorid, and acid excretion, D. W. WILSON nd P. B. HAWK (*Jour. Amer. Chem. Soc., 36 (1914), No. 8, pp. 1774–1779*).—In ontinuation of previous work (E. S. R., 30, p. 766), the authors report experiments with two normal young men who received a simple mixed diet and varying quantities of water at mealtime and between meals.

The excretion of chlorids showed small variations. Increased water ingestion was followed by increased excretion of urinary ammonia, phosphates, and acids. In the author's opinion the data indicate an "increased cell metabolism, causing a formation of acid products which are partly neutralized by ammonia formation and partly cause increased acid phosphates in the urine."

Studies on water drinking.—XIX, Intestinal putrefaction as influenced by the ingestion of softened and distilled waters, C. P. SHERWIN and P. B. HAWK (*Jour. Amer. Chem. Soc., 36 (1914), No. 8, pp. 1779–1785*).—Two series of experiments are reported by which the effect of drinking softened and distilled water on intestinal putrefaction was studied with human subjects. The authors conclude that "both softened and distilled water when taken with meals in volumes ranging from 500 cc. to 1,000 cc. have a tendency to cause a decrease in the putrefactive processes in the intestine as indicated by the urinary indican excretion.

"The nonparallelism of the indican and total ethereal sulphate elimination was again observed."

Acidosis and some of the factors which influence it, R. M. LANG (*Biochem. our., 9 (1915), No. 4, pp. 456–478*).—A number of feeding experiments in which he author himself was the subject are reported. Acidosis in starvation and he influence of the nature of the diet, as well as the specific effects of feeding rotein, fat, and carbohydrate were the factors studied. The following conlusions are drawn:

"The quantity of acetone bodies excreted by the normal individual, on an rdinary diet containing a sufficiency of carbohydrate, is influenced chiefly by he protein intake. On an ordinary diet from 10 to 30 mg. are excreted daily.

exerts its stimulating influence upon the offspring in intra-uterine life and during lactation, and, when the experiment is carried further, and the feeding to the young is continued after weaning, it has an even greater stimulating effect upon growth, weight, and development, and causes earlier and more frequent breeding, and an increased number of offspring in the litters. The stimulating effect upon the sex glands is greater the longer the influence of anterior lobe administration is exerted.

"The extract of pituitary posterior lobe, even after prolonged administration, does not stimulate growth in general, nor the development of the sex glands, as does anterior lobe even after a very short period. . . .

"Ovarian extract (corpus luteum), when fed to the male, especially, causes a tendency toward the deposition of fat, not only in the body generally, but in the testes and other glands as well, with a resultant marked increase in weight. The fur is heavier and coarser than in the animal fed with the posterior lobe extract. It does not cause an early descent of the testes. . . .

"Following ovarian feeding there is, as compared with conditions in the control, increased development and activity of the female sex glands, increased follicle formation, a moderate increase in interstitial tissue and increased branching of the fimbriated extremity of the tube. Prolonged ovarian feeding, e. g., for 5 to 6 months, to the male rat, as compared with the control, has the following effect: The gross size and weight of the testes, both absolutely and in proportion to the body development, is less, and histologically the sex glands of the male show a retarded development and evidences of diminished activity. The definitely retarding influence of ovarian extract upon the male sexual development is exerted throughout the life of the animal."

Influence of various salts on the reproductive process, R. EMMERICH and O. LOEW (*Arch. Hyg., 84 (1915), No. 6–7, pp. 261–282, fig. 1*).—This reports a study made on the effect of calcium, sodium, and magnesium salts on the number and weight of offspring and on the reproductive process of mice, guinea pigs, and rabbits.

Calcium chlorid increased the number of offspring and was decidedly superior in this respect to either potassium chlorid or magnesium chlorid. Sodium chlorid was also beneficial in increasing the number of offspring. It is thought that these salts stimulate the production of the egg cells in the ovary, thus resulting in larger litters.

The control of sex by food in five species of rotifers, D. D. WHITNEY (*Jour. Expt. Zool., 20 (1916), No. 2, pp. 263–296, figs. 13*).—It is shown that in the American and English rotifer *Hydatina senta* food conditions are the controlling factors in regulating the parthenogenetic production of the two sexes.

Histological study of the "pigment specks" of swine, OLT (*Ztschr. Fleisch u. Milchhyg., 26 (1916), No. 7, pp. 97–100, fig. 1*).—This reports a microscopical study made of the pigment specks found in the epithelial cells of the mammæ of swine.

Acid poisoning due to oat feeding, A. MORGEN and C. BEGER (*Hoppe-Seyler's Ztschr. Physiol. Chem., 94 (1915), No. 5–6, pp. 324–336*).—In studies with rabbits the authors found that the deleterious effect of oats fed alone was not due so much to a lime deficiency as to an acid poisoning which results in a bone disease. The addition of dicalcium phosphate was found to be ineffectual in remedying this condition, as was also sodium chlorid. Sodium carbonate proved to be the most effectual in neutralizing the effect of the acid poisoning and in increasing the live weight of the rabbits.

Bacteriological studies on forage conservation in the silo, C. GORINI (*Ann. Ist. Agr. [Milan], 12 (1913–14), pp. 89–105, fig. 1*).—This is a continuation of

work previously noted (E. S. R., 32, p. 363). It was found possible to control the lactic and butyric acid formations in the silo by the inoculation of certain ferments.

The value of lactic acid bacteria in the ensiling of beet tops, D. MEYER (*Illus. Landw. Ztg., 35 (1915), No. 46, pp. 309–310*).—According to the author, it has been demonstrated that the inoculation of beet-top silage with a culture of lactic acid bacteria improves the quality of the silage and aids in the retention of the digestible nutrients of the feed.

Value of brewery waste products under a new method of preservation, ULRICH (*Ztschr. Öffentl. Chem., 21 (1915), Nos. 6, pp. 85–90; 7 pp. 102–105*).—Analyses are given of brewers' grains, brewery refuse, and brewers' yeast when preserved by a newly patented method.

The preparation of straw meal and the baking of cattle bread, C. BORCHERT (*Illus. Landw. Ztg., 35 (1915), No. 42, pp. 287, 288, figs. 3*).—A method of making cattle bread from straw meal is described.

[Feeding stuff analyses], R. E. ROSE and E. P. GREENE (*Fla. Quart. Bul. Dept. Agr., 26 (1916), No. 1, pp. 94–131*).—Analyses are given of cotton-seed meal, grapevines, corn bran, ground corncobs, ground shucks, ground corn with cob, Mexican clover, ground beggar-weed hay, ground peanut vines, dried beet pulp, shipstuff, molasses feed, meat scrap, alfalfa meal, wheat middlings, wheat bran, shorts, distillers' dried grains, rice bran, and various mixed and proprietary feeds.

Summary prospectus for a proposed building and operation of stockyards and abattoir, to be located near the city of Lexington, R. M. ALLEN (*Kentucky Sta. Food and Drugs Bien. Rpt., 8 (1913–1915), pp. 12–20*).—The general condition of the slaughtering industry in and about Lexington, Ky., is here discussed, with special reference to the proposed construction of stockyards and abattoir.

Report of the Royal Commission on the meat export trade, P. W. STREET (*Rpt. Roy. Com. Meat Export Trade Aust., 1915, pp. 50*).—A report of a very complete investigation made of the meat export trade of Australia, with special mention of the activities of American concerns therein.

A survey and census of the cattle of Bengal, J. R. BLACKWOOD (*Calcutta: Govt., 1915, pp. III+34+XC, pls. 29*).—An account of a government inquiry made in regard to the breeds of cattle of Bengal, their care and management, and methods of improvement.

Africander cattle, K. SOMMERFELD (*Tropenpflanzer, 19 (1916), No. 1, pp. 24–33, figs. 4*).—A general account of the breed characteristics, body measurements, and utility value of the native cattle of German Southwest Africa.

Triplet calves (*Jour. Heredity, 7 (1916), No. 3, pp. 135–137, figs. 2*).—A general discussion of the practicability of breeding a strain of live stock that will produce an unusual number of young. Instances of the inheritance of this quality among cattle and sheep are cited.

[Animal husbandry studies], E. J. IDDINGS (*Idaho Sta. Bul. 84 (1915), pp. 8–12*).—In an experiment with four lots of pigs comparing cooked potatoes, alfalfa hay, and tankage when fed supplementary to a basic grain ration, the most economical gains were made by the lot receiving the alfalfa supplement. Warming the feed did not pay.

In a test in which one lot of sows received a full grain ration, a second lot one-half allowance of grain and alfalfa whole in a rack, a third lot the one-half grain ration and cut alfalfa mixed with the grain, and a fourth lot the same ration as lot 3 except that the mixture was steamed before feeding, the most satisfactory and economical ration was found to be a limited amount of grain supplemented with hay fed in a rack.

In a test in which peas and oats, alfalfa, mixed grasses, and clover were compared as supplements to a grain ration it was found that the peas and oats pasture made a relatively good showing. The mixed pasture was found to be not so valuable.

In the hogging off of peas one lot containing 1.32 acres was used for 25 days by 20 pigs averaging 78.5 lbs., a second lot of 1.42 acres for 38 days by 20 pigs averaging 84.8 lbs., and a third lot of 1.51 acres for 30 days by 15 pigs averaging 54.7 lbs., and for 44 days by 30 pigs averaging 70.8 lbs. Figuring pork at $6.00 per 100 lbs., the peas produced an average return of $25.53 per acre or $2.13 per 100 lbs. of peas in the field. In this experiment the second lot was fed rolled barley as a supplement at the rate of 2 lbs. per 100 lbs. of live weight, but the results did not justify the additional labor.

The following table is compiled from four years' weights of fleeces, two years' records of weights of ewes, weights of lambs at birth, and daily gains of lambs, and a single season record on relative breed maintenance.

Results of tests in sheep breeding and management.

Breed.	Weight of ewes.	Cost of daily maintenance per head.	Birth weight of lambs.	Lambing percentage.	Average daily gain of lambs.	Average weight of fleece.
	Pounds.	*Cents.*	*Pounds.*		*Pound.*	*Pounds.*
Southdown	152.0	1.48	6.8	138.5	0.39	7.7
Shropshire	173.0	1.95	7.1	112.5	.48	12.2
Hampshire	190.0	2.22	9.0	77.5	.60	8.2
Cotswold	184.5	2.22	6.6	125.0	.....	17.3
Rambouillet	166.5	1.48	8.4	100.0	.47	14.8

[Live stock experiments] (*New Mexico Sta. Rpt. 1915, pp. 69–79*).—In an experiment with four lots of 8 pigs each, in which lot 1 was given a full concentrate ration, lot 2 a part concentrate ration in the proportion of 1 lb. concentrate to 100 lbs. live weight, lot 3 a concentrate and dried beet pulp ration in the proportion of 1 lb. concentrate and 0.5 lb. beet pulp to each 100 lbs. of live weight, all of the lots receiving as much choice alfalfa hay as they would eat, the results favored the feeding of a full ration. The addition of beet pulp to the ration increased the gains 20 per cent, but this was not enough to pay for the increased cost.

Two lots of pigs were fed an allowance of 2 lbs. of concentrate for each 100 lbs. live weight, lot 1 receiving in addition all the corn silage and lot 2 all the alfalfa hay they would consume. The results of this experiment were in favor of alfalfa hay, both in gains and cost of gains.

In an experiment to determine what use may be made of crops grown under dry-farm conditions for feeding range steers for beef one lot of steers was fed entirely on dry-farm crops, making use of cowpea hay to furnish the protein necessary to balance the ration properly. The other lot was given an allowance of cotton-seed meal in place of the cowpea hay. Both lots were fed silage made of milo maize and Kafir corn, and both had an allowance of ground milo maize and Kafir-corn heads, but the roughage fed to one lot was shredded milo maize fodder and to the other cowpea hay. The results for 76 days show quite markedly in favor of the cowpea-hay fed lot, in both daily gains and cost of gains. The average daily gain per head of the cowpea-hay fed lot was 2.86 lbs., while with the cotton-seed meal lot it was 2.4 lbs.

In continuation of a nutrition project, begun several years ago, calves and yearlings, 2-year-olds and 3-year-olds, were fed for 120 days on alfalfa and milo-maize

meal. Average daily gains for the four ages of 1.55, 1.88, 2.11, and 1.57 lbs. were obtained, consuming 7.81, 10.75, 10.8, and 14.16 lbs. of feed per pound of gain, and dressing 59.92, 59.49, 58.4, and 58.87 per cent for the respective lots. These results agree in general with those of previous work (E. S. R., 32 p. 467) in which alfalfa hay was fed. It was found, however, that the percentages of dressed beef yielded by the different lots of steers in the alfalfa and milo-maize series were, on the whole, appreciably higher than the corresponding figures in the alfalfa-hay series.

Preliminary results of experiments in hog feeding at the college of agriculture, S. B. DUBHAM (*Philippine Agr. and Forester, 4 (1915), No. 8, pp. 173–178*).—Hog feeding experiments conducted at the Philippine College of Agriculture are reported. On a combination of rice bran and pasture the pigs made average daily gains for 85 days of 0.521 lb. per head.

Feeding wheat to fattening swine, L. A. WEAVER (*Missouri Sta. Bul. 136 (1915), pp. 3–35, figs. 8*).—In two experiments six lots of 6 and 12 hogs each were fed during two periods of 78 and 42 days, or a total of 120 days, with the following results:

Summary of average results in two swine-fattening experiments.

Lot.	Ration.	First period of 78 days.			Entire period of 120 days.		
		Daily gain per hog.	Grain consumed per pound of gain.	Dressing percentage.	Daily gain per hog.	Grain consumed per pound of gain.	Dressing percentage.
		Pounds.	*Pounds.*		*Pounds.*	*Pounds.*	
1	Wheat	1.25	4.55	80.60	1.25	4.83	85.50
2	Wheat and corn, 1:1	1.18	4.93	82.50	1.18	5.28	86.50
3	Wheat, corn, and tankage, 5:5:1	1.39	4.47	80.50	1.44	4.85	85.00
4	Wheat and tankage, 10:1	1.51	4.24	81.90	1.52	4.69	87.80
5	Corn and tankage, 10:1	1.24	4.62	81.15	1.27	4.98	85.00
6	Corn	1.08	5.12	80.15	1.00	5.82	87.30

Complete data are given on the dressing percentage, weight of blood, liver, entrail fat, heart, tongue, head, shoulder, side, ham, leaf fat, and lard for representative hogs from the several lots.

Results from similar tests at other stations are included.

Determination of the race of swine by the protein differentiation method, A. LÜHNING (*Landw. Jahrb., 47 (1914), No. 3, pp. 443–475, figs. 6*).—By the protein differentiation method it was found possible to distinguish between the *Sus vittatus*, *S. scrofa*, and various other species of wild and domestic swine.

Feeding experiments with sugar and meat meal for horses, L. GREVE (*Berlin. Tierärztl. Wchnschr., 31 (1915), No. 26, pp. 301–303*).—It was demonstrated that as much as 6 kg. of raw sugar and 900 gm. of meat meal, daily, may be fed to horses without harmful results. When fed in moderate amounts as a supplement to an oat and hay ration, work horses did well and increased in weight.

[Poultry husbandry studies], P. MOORE (*Idaho Sta. Bul. 84 (1915), pp. 28, 29*).—Three pens of 30 White Leghorn pullets each were fed the following rations for one year: Pen 1, a grain ration of wheat, oats, and barley 15:2:2, and all the grit they would eat; pen 2, a grain ration of wheat, peas, oats, barley, Kafir corn, millet, sunflower seed, and buckwheat 12:2:3:2:1:1.5:0.5:1, and a mash ration of bran, shorts, corn meal, wheat meal, fish meat meal, and charcoal 2:2:1:1:2:1 per cent; and pen 3, a ration the same as that given

pen 2 except that corn was substituted for peas and the oats were fed in the proportion of two parts instead of three.

Pen 1 averaged 24 eggs per pullet; pen 2, 116 eggs; and pen 3, 131 eggs. The percentage of eggs under 2 oz. in pen 1 was 66⅔; in pen 2, 5.5; and in pen 3, 6¾. Pen 1 cost, exclusive of labor, $19.36, and brought in only $18.45; pen 2 cost $34.91, with an income of $87.15; and pen 3 cost $33.22, with an income of $97.20.

[Comparison of methods of managing poultry], MRS. G. R. SHOUP (*Washington Sta., West. Wash. Sta., Mo. Bul., 3 (1916), No. 11, pp. 9–14*).—This continues work previously noted (E. S. R., 34, p. 669). The pen of pullets, which had been receiving ordinary care, were shut in a house, due to the extreme cold winter weather, and were fed on green feed. This treatment was found to increase the egg production, the egg yield being 30 per cent greater the first 17 days of January than it was the last 17 days of December. It is concluded that housing during the winter, the feeding of green feeds, and regular feeding all go to increase the egg yield.

The lengthening of the work day by artificial light seemed to be followed by increased egg yields, as in the previous work.

Poultry in Texas, J. E. RICE (*Agr. and Mech. Col. Tex. Ext. Serv. Bul. B–10 (1916), pp. 109, figs. 49*).—General information on the breeding, feeding, care, and management of poultry under Texas conditions is given.

What the size of an egg means, D. E. WARNER and W. F. KIRKPATRICK (*Jour. Heredity, 7 (1916), No. 3, pp. 128–131, figs. 2*).—The authors have found, in their work at the Connecticut Storrs Station, that contrary to current belief neither small nor large eggs are necessarily laid either at the beginning or end of a hen's laying period, but that they are most often laid during the time of heavy egg production.

"The number of eggs laid by the 1,820 hens during the 20 months' period was 199,137, of which 103 were small (less than 0.09 lb.) and 89 were large (over 0.179 lb.). . . . The 103 small eggs were laid by only 85 hens, showing that only a small percentage of the hens laid a small egg during their first year of laying. Four hens out of the 85 laid 2 small eggs at different periods of their productivity. . . .

"It was found that only 2 eggs out of a total of 103 indicate a resting period after the production of a small egg. In every other case the small egg was found in an almost uninterrupted series of normal eggs. . . .

"The figures also show that as a rule hens do not lay extremely small eggs at the beginning of their laying periods, but that such eggs are laid at a time when the hen is laying most heavily. It seems clear, therefore, that the small egg is not due to the fact that it is a hen's first attempt, or to the fact that it is the end of her laying period and represents exhausted power. A fairer assumption as to the cause of these small eggs would be that they are due to some mechanical interference with the hen's normal functions—that they are laid whenever a particle of blood, foreign element, or an undeveloped yolk is drawn into the passage where the shells are formed, and that contractions of the oviduct then cause an egg to be laid completely formed, but without having undergone normal development. . . .

"[Of the] 89 large eggs, nearly 99 per cent were laid at the time of heavy production, and in most cases the hen did not rest after laying such an egg, but continued her uninterrupted yield of normal eggs. . . . It further appeared that in most cases the hen did not rest before laying a large egg any more than she did after such a performance. Forty-five of the large eggs were laid without any previous resting period, 31 were laid with a resting period of 1 day before, and 10 were laid with a resting period of 2 days."

DAIRY FARMING—DAIRYING.

Cost of producing milk on 174 farms in Delaware County, New York, A. L. THOMPSON (*New York Cornell Sta. Bul. 364 (1915), pp. 109–179, figs. 19*).—The purpose of this investigation was to find out as nearly as possible what it costs the average farmer to produce milk in the hill regions of New York. All the data for the investigation were collected by the survey method, complete records for two years from 174 typical farms in Delaware County, N. Y., being included. The averages for the two years are summarized in the following table:

Summary of dairy farm survey.

Kind of data.	1912	1913
Number of cows per herd	30.5	28.9
Value of cows per head	$40.00	$47.00
Pounds of milk produced per cow	4,644	4,695
Pounds of milk sold per cow	4,575	4,600
Pounds of milk fat produced per cow	214	217
Pounds of grain per cow and accompanying stock	2,004	2,256
Value of grain per cow and accompanying stock	$31.33	$32.25
Pounds of hay and forage per cow and accompanying stock	4,504	4,430
Value of hay and forage per cow and accompanying stock	$40.36	$34.11
Pounds of silage per cow and accompanying stock	1,703	1,656
Number of feed units, excluding pasture, per cow and accompanying stock	4,187	4,321
Acres of pasture per cow and accompanying stock	3	3
Annual cost of pasture per cow and accompanying stock	$4.29	$3.82
Cost of bedding per cow and accompanying stock	$0.91	$0.79
Value of buildings per cow and accompanying stock	$68.00	$67.00
Annual cost of buildings per cow and accompanying stock	$5.31	$5.66
Hours of human labor per cow and accompanying stock	158	129
Cost of labor per cow and accompanying stock	$22.45	$18.11
Miscellaneous costs per cow and accompanying stock	$1.19	$1.22
Cattle cost per cow and accompanying stock	$1.00	(a)
Cost of dairy equipment per cow	$0.49	$0.45
Cost of hauling milk per cow	$5.90	$6.10
Total cost per cow	$118.84	$107.87
Total returns, other than milk sold, per cow	$11.21	$14.21
Loss per cow	$32.11	$12.50
Amount received per pound of milk, cents	1.65	1.76
Cost per pound of milk, cents	2.35	2.03
Cost per quart of milk, cents	5.10	4.30
Cost per pound of milk fat, cents	51	44
Miles from station	2.7	2.7
Per cent of butter fat in milk	4.6	4.6

[a] There was enough stock raised to show an appreciation in 1913.

In 1912, 15 dairy herds, or about 1 in 11, showed a profit. The average cow paid all costs excepting the value of hay and forage raised on the farm, for which only 28 per cent of its farm value was obtained. In 1913 dairy conditions were more favorable, as grain and forage were cheaper, and milk brought a better price, and 52 herds, or 30 per cent, showed some profit. The average cow paid all costs except hay and forage raised on the farm, and paid 66 per cent of the farm value for this.

In 1913 the cost of hauling milk per cow was $4 in the herds with more than 55 cows, and $8 in the herds with 20 or less cows. The annual cost for sheltering a cow was $7 in the herds with 20 cows or less, and $4 in the herds with over 40 cows. The average investment in buildings per cow for the herds with 20 or less cows was $76. In the herds with 41 or more cows it was $54. The value of the feed used per cow did not vary greatly in proportion to the size of herd. The milk production was higher in the medium-sized herds than in the large or small herds. The size of herd did not greatly affect the cost of milk production, this being 2.42 cts. per pound in the herds with 20 or less cows, and 2.37 cts. in the herds with over 40 cows.

In 1912 the value of pasture land on farms 1 mile or less from the milk station averaged $25 per acre; on farms over 1 mile and not more than 3 miles from market, $20 per acre; on farms from 3 to not more than 4 miles from market, $18 per acre; and on farms over 4 miles from market, $16 per acre. The cost of hauling milk on farms 1 mile or less from market was $4 per cow, or 8.7 cts. per 100 lbs. of milk sold. When the distance hauled was more than 4 miles the cost of marketing was $7 per cow, or 15.3 cts. per 100 lbs. of milk sold. The production of milk, the cost of feed, and the cost of production did not differ greatly with the distance from market.

Cows that were given $41 worth of feed in addition to pasture produced milk for 1.47 cts. per pound and made an average profit of $13. This profit was made on a production of 4,100 lbs., which is 363 lbs. below the average for the State. When the value of the grain, hay, and silage was increased by $28 the milk production was increased by 791 lbs. and the profits were decreased by $22. After this point each additional increase of barn feed resulted in increased production, but the milk cost more and the loss per cow was increased. One-half of the dairymen who used $55 or less of winter feed per cow produced milk for 2 cts. per pound or less, but those who gave more winter feed lessened their chances of producing milk cheaply. The cows that received on an average only 2,677 feed units produced 3,925 lbs. of milk which cost 1.80 cts. per pound. Cows that received an increase of 917 feed units produced an increase of 229 lbs. of milk. Increases in feed in the next two groups resulted in increased production but the cost per pound of milk remained much the same. When the cows were fed more than 5,421 feed units the production continued to increase, but the increased value of the feed necessary to make this change was out of proportion to the value of the milk.

Silos were found in the larger dairies, and more intensive methods of feeding are being followed on the farms that have silos. The value of the feed used per cow and accompanying stock on the farms with silos was $86 in 1912 and $80 in 1913, and on farms without silos $79 and $71. The average production of milk per cow in the herds where silage was fed was 4,791 lbs. in 1912 and 4,778 lbs. in 1913, and in the herds not fed silage 4,516 lbs. in 1912 and 4,624 lbs. in 1913. The cost of production per pound of milk where silage was used was 2.32 cts. in 1912 and 2.08 cts. in 1913, and where silage was not used 2.38 cts. and 1.99 cts.

A larger expenditure for feed and more feed units were used in the herds of higher value. The amount of labor spent per cow in the different groups was fairly constant. The production per cow was higher in the herds of high value. Intensive feeding of the average cow did not pay, but the group containing cows valued at $55 or more was able to use as much as $94 worth of feed and show a profit.

The milk from the Holstein group tested the lowest in fat, averaging 4.1 per cent in 1912 and 4.2 per cent in 1913. The Jersey group tested the highest, with an average test of 4.8 per cent in 1912 and 4.7 per cent in 1913. Not counting pasture the Holsteins consumed more feed than did the other groups but were closely followed by the Jerseys. The Jerseys used more expensive feed, so that their ration cost a little more than the Holstein ration. In 1913 the average profit per cow among the 542 Holstein cows was $3, while the 3,026 Jersey cows showed an average loss of $15, and the cows of mixed breed a loss of $19 per cow. The Holstein herds, however, were mainly on the valley farms, where natural conditions for economical milk production were better, and this may help to account for the better showing made by the Holstein group.

The highest production was found in the herds for which the milk fat test of the milk was low. In 1913 the production per cow in the herds for which the test of the milk ran 4.4 per cent of milk fat or below was 4,998 lbs., while in the herds for which the milk tested from 4.5 to 4.6 per cent it was 4,738 lbs., for those with milk testing from 4.7 to 4.8 per cent, 4,431 lbs., and for those with milk testing over 4.9 per cent, 4,584 lbs. The cost of producing milk was less and the profit per cow was greater in the herds for which the test of the milk was low. Milk testing 4.4 per cent of milk fat, or less, cost 1.9 cts. per pound to produce, and milk testing 4.9 per cent of milk fat, or more, 2.19 cts.

The cost of producing 1 lb. of milk was 0.28 ct. less in the herds for which milk records were kept. The keeping of records apparently decreased the loss by $11 per cow in 1912, and in 1913 changed a $14 loss to a $3 gain.

In every instance the value per cow increased when the production increased, but an increase of 1,000 lbs. of milk made only a small increase in the value per cow. This means that more milk can be produced from $1,000 invested in good cows than can be produced from a similar amount invested in poorer cows.

The cost of producing 100 lbs. of milk was greater in the low-producing herds. In order to produce milk at a profit in 1912 it required an average production of 7,219 lbs. per cow.

Data on the cost of producing milk in other States are included.

Dairy husbandry (*Washington Sta. Bul. 127 (1915), pp. 9–11*).—Cows fed beet pulp, moistened with 5 parts by weight of water, consumed the feed with considerable relish and rapidly increased in milk yield during a two-week period. Although it was difficult to accustom the cows to eating the feed at first, later they would eat from 6 to 8 lbs. more of the soaked pulp than they would of the corn silage. The general condition of the cows fed the beet pulp was comparable with that of those fed corn silage, and there was no appreciable difference in their weights. Since their feeding value is about the same, it appears that the extended use of beet pulp as a substitute for silage depends largely on the relative cost of producing and preserving silage and the cost of dried beet pulp.

Three lots of 6 calves each were fed 90 days, the grain ration consisting of ground oats, wheat, and barley, with bran, together with clover or alfalfa hay, lot 1 receiving in addition skim milk, lot 2 Blatchford's calf meal, and lot 3 a homemade calf meal. Skim milk gave the best results as a substitute for whole milk, yet the other feeds, with a limited use of skim milk, gave fair results. The skim-milk lot made the largest gains per day with the lowest cost per pound. Grain mixtures fed dry rather than mixed with milk gave the best results.

A number of cows were divided without regard to breed into groups of large and small cows, cows weighing 1,100 lbs. or more being taken as large. During a five-month period it was found that with the cost of feed alone considered the small cows produced milk fat for 1 ct. per pound less than the large cows, but did not produce milk as cheaply. When the total expenses were considered, the large cows produced milk fat at 3 cts. less per pound, and milk at 57 cts. less per 100 lbs. than the small cows.

[Feeding experiments with dairy cattle], R. Carr (*Michigan Sta. Rpt. 1915, pp. 234, 235*).—Two lots of four cows each were fed five months in periods of two weeks by the reversal method, one week intervening between periods, one group receiving 30 lbs. per day of silage as a succulent feed, the other group 30 lbs. of roots. The cows were allowed all the alfalfa hay they would eat and a grain ration which was not changed throughout the test, each animal being given approximately 1 lb. of grain to 4 lbs. of milk. Other conditions were maintained as identical as possible.

There seemed to be no appreciable difference between the silage and root rations as to the amount of hay eaten. Each group and each individual cow produced more milk from the root ration, but the difference was not very great, averaging 0.7 lb. per day per cow. While the number of cows was small and the test covered but one season, it is believed that the figures would seem to warrant the conclusion that the roots are at least as good as the corn silage. Data on the cost of growing and handling these crops seem to indicate very little difference in that respect, local conditions influencing the cost greatly.

Experiments in feeding dairy cows (*New Mexico Sta. Rpt. 1915, pp. 66–69*).—In an experiment with two lots of dairy cows, fed for 30-day periods, in which one lot received a ration consisting of 30 lbs. of corn silage, 1 lb. of concentrate to each 5 lbs. of milk, and all the choice alfalfa hay they would eat, and the other lot the same feed with the exception of the corn silage, for which 8 lbs. of dried beet pulp was substituted, a 10.6 per cent larger yield of milk and milk fat was obtained from the lots fed dried beet pulp. However, the milk cost 28 per cent more and the fat 33⅓ per cent more.

Dairy herd records, their value, and how to keep them, A. B. NYSTROM and R. E. HUNDERTMARK (*Washington Sta. Popular Bul. 97 (1915), pp. 3–16, figs. 6*).—General information on how to keep records, and the value of such records in increasing dairy profits, is given.

Report of the department of dairy husbandry, O. F. HUNZIKER (*Indiana Sta. Rpt. 1915, pp. 34–45*).—In continuation of work previously noted (E. S. R., 32, p. 672) a calf-feeding experiment was carried on in which one lot received whole milk, skim milk, ground corn and oats as a dry mash, alfalfa hay, and corn silage, and another lot a home-mixed calf meal containing hominy feed, linseed meal, red dog flour, and dried blood, equal parts by weight, in place of the skim milk. The following conclusions are drawn:

"The use of skim milk as a feed for young calves is increasing in those sections where it is available in large quantities. Its use for this purpose should be encouraged unless its market value is very much above 30 cts. per 100 lbs. So long as skim milk is available as a feed for live stock, milk substitutes for dairy calves are of very limited value.

"In certain sections of the State the chief product sold from the farm is whole milk. Under these conditions the growing of dairy heifers becomes a very expensive proposition unless a milk substitute may be secured, making it possible to reduce the amount of milk required for calf feeding to the minimum. Under such conditions the use of a home-mixed calf meal is advisable, although the calf so produced will not be as well developed at six months of age as if fed milk during its early growing period.

"The prices charged by concerns manufacturing calf meals are usually very much above the actual cost of producing them, chiefly on account of advertising costs, transportation charges, and dealers' profits. All things being equal, so far as the efficiency of the ration is concerned the use of a ready-prepared calf meal is largely prohibitive on account of the high retail prices of such feeds.

"The results, from the standpoint of gain in weight and growth in height, produced by feeding Blatchford's calf meal do not warrant its recommendation as an absolute milk substitute for the growing of dairy calves.

"In order for a ration to be considered an unqualified success for dairy calves, it should produce at least 1 lb. of gain per day as an average for the first six months of the life of the calf. An average daily gain of 1.5 lbs. is not uncommon, although slightly above that which the average dairyman may expect.

"The amount of grain mixture and dry roughage consumed by dairy calves is a splendid index to their thriftiness. The development of an appetite for dry feeds by dairy calves is governed by the type of milk or milk substitute ration

fed and the method of feeding the supplementary feeds. The feeder's ability to encourage and teach the calves to eat dry feeds is an important factor to consider in raising calves by hand.

"The amount of food nutrients required per day by growing calves is, approximately, ¾ lb. of protein, 1 lb. of carbohydrates, and 1.05 lb. of fat. The above figures are based upon the total amount rather than the amount of digestible nutrients consumed.

"The rate of growth in height of dairy calves is rather uniform during the first six months of their life. The average monthly growth for an average-sized calf should be from 1.5 in. to 2 in., although certain individuals will very much exceed these figures.

"As dairy calves advance in age their relation between height and weight gradually changes. A calf at 30 days of age should weigh, approximately, 3 lbs. for each inch in height. This figure gradually increases until, at six months of age, the average calf should weigh, approximately, 6.5 lbs. for each inch in height."

Work thus far completed indicates that cotton-seed meal has very little effect on the breeding properties of dairy heifers.

In continuation of the report previously noted (E. S. R., 30, p. 575) on the pasteurization of cream for butter making, it appears that "the germ-killing efficiency of pasteurization varies with the bacterial flora of the cream, and the latter in turn varies with the season of the year.

"Extremely high pasteurizing temperatures, such as 185° F. and higher, while efficient in destroying germs, may cause a very poor quality of butter when used on very sour cream. The resulting butter tends to have a disagreeable oily flavor, suggesting also fishiness. This is particularly true in early summer when the cows are on green pasture and the butter fat contains a relatively high percentage of olein, which appears to yield to the oxidizing action of the combination of high acid and high heat. Under these conditions the lower pasteurizing temperatures, such as 160 to 165° flash, and 145° holding, give decidedly better results.

"Vat pasteurization, while producing a good flavor, appears to give the butter a more or less mealy texture. This is probably due to the prolonged exposure to heat due to slow cooling.

"Butter made from cream properly pasteurized shows a decided improvement over butter made from raw cream of the same quality."

Directions for the manufacture of commercial buttermilk from skim milk or whole milk, based on the station work, are presented. In order to produce a buttermilk of good quality and possessing the proper balance of flavor, acidity, body, and holding-together property it seems necessary to use two separate and distinct species of lactic acid bacteria, viz, *Bacillus bulgaricus* and *Streptococcus lacticus*. Where a whole milk buttermilk is desired (buttermilk containing milk fat) a much better flavor is produced when the whole milk is first separated, only the skim milk soured, and the cream mixed back into the product after the fermentation is completed. In this way the prolonged exposure of the fat to the high acid, which gives the finished product a rather coarse flavor, bordering on rancidity, is avoided and the buttermilk has a rich, smooth, and creamy flavor.

Milk inspections, R. M. Allen (*Kentucky Sta. Food and Drugs Bien. Rpt., 3 [1913–1915], pp. 21–25*).—It is stated that very practical and effective methods of milk inspection have been worked out in Kentucky, and that these methods are showing a widespread improvement in both the chemical and bacteriological purity of the State's milk supply. Bacteriological examinations directed toward both market samples and the processes in the dairy and milk depots

have been the chief means for accurate knowledge of sanitary condition and the omissions in practice responsible for contaminated milk.

Marked results were noted as the result of the elimination of dust from the barn. It is stated that dust in the barn and the failure to sterilize utensils are two of the chief reasons for high bacterial counts. These conclusions are rather in contrast to those reached by the New York State Station (E. S. R., 34, p. 183).

Hygienic milk, J. PRITZKER (*Schweiz. Apoth. Ztg., 53 (1915), Nos. 42, pp. 583–586; 43, pp. 593–597; 44, pp. 609–612; 45, pp. 624–628*).—A summary and digest of data, including the findings of bacteriological examinations of milk prepared under various conditions of cleanliness. It is maintained that raw milk obtained and handled with proper precautions is the best substitute for mother's milk. Pasteurization and sterilization reduce the number of bacteria, but boiling alters the chemical composition of the milk. Sterilized milk is considered responsible for rachitis and scurvy in infants.

Slimy and ropy milk, R. E. BUCHANAN and B. W. HAMMER (*Iowa Sta. Research Bul. 22 (1915), pp. 207–295, figs. 10*).—A study of slimy and ropy milk sent in for examination to the dairy bacteriological laboratories has shown the following:

"Cultures of organisms secured from slimy starters, apparently typical *Streptococcus lacticus* forms, sometimes showed marked capacity to produce ropiness when inoculated into sterile milk. This slime-producing power is evidently a variable characteristic, appearing and disappearing without apparent cause. Associative action of organisms in some cases is responsible for ropiness. Two organisms, neither of which alone can cause ropiness, may, when grown together, cause the medium to become slimy. *Bacterium (lactis) viscosum* is one common cause of slimy milk. Certain peptonizing bacteria, as *B. peptogenes*, produce a very slimy residuum after digestion of the casein. *B. bulgaricum* and certain related high acid organisms frequently produce marked viscosity in milk.

"Sliminess in milk is apparently due to different causes with different organisms: Gum and gumlike capsular materials partially soluble, or at least swelling in water, are frequently the same. In many cases there seems to be a direct relationship between chain formation of streptococcus and the development of ropiness, likewise between the numbers of bacteria and ropiness. Associative action between two distinct organisms resulting in great increases in number of each is not uncommon as a cause of ropiness. Methods of control and prevention of slimy milk are discussed."

Keys to the organisms that have been described as responsible for slimy production in milk are presented. An attempt has been made to clear up synonymy. Descriptions of 33 species of bacteria that have been found associated with milk are given, and the literature reviewed. A bibliography is appended.

Effect of salt on butter flora, W. GILTNER and J. D. BAKER (*Michigan Sta. Rpt. 1915, p. 209*).—It has been found that salt to a concentration of 12 per cent does not in all cases retard growth, and that the growth of some organisms is not prohibited by 20 per cent of salt. Streptococci are sensitive to salt, while micrococci and staphylococci can tolerate a high percentage. Most of the yeasts and torulæ of butter are not easily affected by salt, yet they can not withstand as much salt as some of the cocci. Salt (8 per cent) retards the physiological processes of most organisms. Micro-organisms which liquefy casein and gelatin are more easily affected by salt than nonliquefiers. Some organisms by continued cultivation on salt agar increase their maximum tolerance for salt.

Butter making on the farm, A. B. NYSTROM and R. E. HUNDERTMARK (*Washington Sta. Popular Bul. 96 (1915), pp. 23, figs. 10*).—This bulletin deals with the importance of sanitation in butter making, ripening cream, steps in the manufacture of butter, kinds of churns, preparing butter for market, and marketing farm butter.

VETERINARY MEDICINE.

Table of veterinary posology and therapeutics for students and practitioners, G. A. BANHAM and W. J. YOUNG (*London: Baillière, Tindall & Cox, 1915, 4. ed., pp. XVI+272; rev. in Vet. Jour., 71 (1915), No. 483, pp. 453, 454*).—The fourth edition of this handbook.

Principles of general physiology, W. M. BAYLISS (*London and New York: Longmans, Green & Co., 1915, pp. XX+850, figs. 259*).—This new volume on general physiology treats of those subjects which are common to all living organisms. A brief summary of the material considered is appended to each chapter.

A very complete bibliography covering 80 pages is included.

Report of the live stock sanitary commissioner of the State of Maine on contagious diseases of animals, 1914, A. JOLY (*Rpt. Live Stock Sanit. Comr. Me., 1914, pp. 139, pls. 14*).—A report of the occurrence of, and work of the year with, diseases of animals.

Report of the bacteriologist, W. GILTNER (*Michigan Sta. Rpt. 1915 pp. 194–204*).—These pages contain partial results of a study by L. R. Himmelberger of the immune bodies of antihog-cholera serum and methods for diagnosing hog cholera, and a review of the outbreak of the foot-and-mouth disease in 1914, by E. T. Hallman.

Biennial report of the state live stock inspector of the State of Tennessee, 1913–14, G. R. WHITE (*Bien. Rpt. State Live Stock Insp. Tenn., 1913–14, pp. 22, figs. 2*).—This account of work for the period under report deals particularly with that of hog-cholera control.

Report on the veterinary division, A. S. MILNE (*Rpt. Dept. Sci. and Agr. Brit. Guiana, 1913–14, App. 4, pp. 5*).—A brief statement of the work of the year.

Annual reports on the civil veterinary department, United Provinces, for the years ending March 31, 1914 and 1915, E. W. OLIVER (*Ann. Rpts. Civ. Vet. Dept. United Prov., 1914, pp. 4+II+25; 1915, pp. 4+II+25*).—These annual reports include accounts of the occurrence of diseases of animals, breeding operations, etc.

Biological investigations of the amins derived from proteins in organ extracts and body fluids, M. GUGGENHEIM and W. LÖFFLER (*Biochem. Ztschr., 72 (1916), No. 5–6, pp. 303–324, figs. 36*).—The authors have studied the effect of certain amins on the isolated guinea pig intestine suspended in Ringer's solution. These amins are derived in the animal organism from the amino acids by the cleavage of carbon dioxid, probably through the agency of bacteria, as demonstrated by earlier investigators.

Very small amounts of β-imidazolethylamin, oxyphenylethylamin, phenylethylamin hydrochlorid, isoamylamin hydrochlorid, indolethylamin hydrochlorid, suprarenin hydrochlorid, etc., were found to exercise a marked tonic effect. Alkali salts of the higher fatty acids, gallic acid, oxalates, citrates, indol, phenol, cresol, guaiacol, and disodium phosphate were found to have a similar action, much larger doses, however, being necessary. In amounts less than 0.1 gm. per 100 cc. of Ringer's solution aliphatic amino acids, silk peptone, solutions of egg white, dioxyphenylalanin, histidin, tryptophan, paraoxyphenylacetic acid, homogentisic acid, cadaverin, putrescin, etc., were found to exercise no reaction.

The relation of such action as a probable etiological factor of intestinal autointoxication and other pathological conditions is indicated.

The fate of amins derived from proteins in the animal organism, M. GUGGENHEIM and W. LÖFFLER (*Biochem. Ztschr., 72 (1916), No. 5–6, pp. 325–350, figs. 7*).—It has been demonstrated that isoamylamin, phenylethylamin, paraoxyphenylethylamin, indolethylamin, and β-imidazolethylamin are detoxicated in the animal organism. This detoxication results from a deamination and subsequent oxidation, the end product being an acid with the same number of carbon atoms as the original amin. As intermediate products in the oxidation of the amins, alcohols were isolated and identified by perfusing the isolated liver with the respective amins. The fact was thus established that the liver is able to oxidize certain alcohols to their corresponding acids.

Normal human blood and serum, and also that of the rabbit, exhibited a tonic effect on the isolated guinea-pig intestine. The active principle causing this effect was found to be soluble in alcohol and thermostable.

Studies in anaphylaxis, XIV–XVII, R. WEIL (*Jour. Immunol., 1 (1916), No. 1, pp. 1–49*).—Four studies are here reported, continuing previous work (E. S. R., 33, p. 82).

XIV. *On the relation between precipitin and sensitizin* (pp. 1–18).—From experimental data it has been demonstrated that passive sensitization toward horse serum can be induced in guinea pigs by injecting intraperitoneally precipitates produced by horse serum and the serum of a rabbit immunized against horse serum. The same results can be obtained by using crystalline egg albumin. Certain quantitative relations have been found to exist between antigen and antibody in producing the precipitates which do not vary outside of certain fairly wide limits. A great excess or deficiency of either factor produces a precipitate which fails to sensitize passively.

"The precipitating substance of immune sera is competent to sensitize guinea pigs passively. In other words, precipitin is also sensitizin [the substance which confers sensitization]. It is conceivable, but improbable, that there may be a fraction of precipitin which lacks the sensitizing function.

"Antibody may be deprived of its precipitating function by heat without suffering a very material diminution in its sensitizing value. This observation corresponds with the previously known fact that 'precipitoid,' or heated precipitin, has retained its combining power with antigen, although it has lost its precipitating power. The precipitating, or ergophore group, is said to be thermolabile; the sensitizing or haptophore group, to be thermostable.

"Only the combining (or haptophore) group is essential to passive sensitization. Anaphylaxis therefore consists simply in the cellular reaction due to the fixation of antigen by cellular antibody. These new data therefore confirm and establish the theory of anaphylaxis supported in previous studies of this series.

"The fact that the coexistence of antigen in the same fluid may inhibit the precipitating power of antibody while only partially interfering with the sensitizing function, as in the prozone experiments, may explain the divergence in the literature between those who maintain that precipitin and sensitizin run parallel in immune sera and those who deny this relationship.

"The phenomenon which has been described as dissociation of the precipitate, which probably occurs within the body and which may be imitated by various laboratory procedures such as extraction by sodium carbonate, sets free antibody in a form which sensitizes passively but fails to give the precipitin reaction. Such a factor, likewise, would upset the normal parallelism between sensitizin and precipitin.

"The foregoing consideration may serve to explain the fact that the presence of antibodies may be demonstrated by means of passive sensitization in spite of

the fact that the test tube reactions, such as agglutination and precipitation, prove ineffective. In infectious disease the coexistence of the antigen (the infectious agent or its product) in the blood might be expected to produce this result."

XV. *Equilibrium in precipitation reactions. Equilibrium in combination* (pp. 19–34).—The supernatant fluid resulting from the preparation of precipitates with rabbit serum, previously immunized against horse serum, and normal horse serum was found to contain both antigen and antibody. Similar results were obtained with raw egg albumin. Purified egg albumin, however, exhibited entirely different results. When treated as above the supernatant fluid never contained both antigen and antibody simultaneously. Raw egg albumin was found to contain more than one antigen, and the antiserum, therefore, correspondingly contained more than one antibody. The protective action of a third colloid, preventing complete interaction of antigen and antibody, has not been demonstrated. Cross precipitations could not be induced by mixing the sera of different rabbits immunized against crystalline egg albumin, but were possible when raw egg albumin was used as antigen.

From the experimental results it is concluded that precipitin and precipitinogen can not exist in the same fluid without undergoing union and producing precipitation. The instances of the apparent coexistence of antigen and antibody reported in the literature must be explained on the basis of multiplicity of antigens.

XVI. *Equilibrium in precipitation reactions. Dissociation* (pp. 35–46).—Experimental data show that "precipitates contain both antigen and antibody, as shown by the fact that they sensitize both actively and passively. If precipitates are treated with salt solution in the incubator, the extracts are found to contain a small amount of antigen, but no antibody. If precipitates are extracted with solutions of sodium carbonate, antigen is readily demonstrable in the extracts. Precipitin can not be demonstrated, but antibody is demonstrable in large amounts, by the method of passive sensitization (sensitizin). Extraction with trypsin and with leucocytes yields both precipitin and precipitinogen."

XVII. *On the coexistence of antigen and antibody in the body* (pp. 47–49).—The author concludes that antigen and antibody may coexist in the same fluids in the test tube in reactive form, and also in the blood and in the cells of the living animal. Antibody, even if in combination with antigen, is still capable of reacting with fresh antigen.

Studies in nonspecific complement fixation, I–V (*Jour. Infect. Diseases, 18 (1916), No 1, pp. 20–87*).—The studies here reported consist of a number of papers as follows: (1) Nonspecific Complement Fixation by Normal Rabbit Serum, by J. A. Kolmer and Mary E. Trist (pp. 20–26); (2) Nonspecific Complement Fixation by Normal Dog Serum, by J. A. Kolmer, Mary E. Trist, and G. D. Heist (pp. 27–31); (3) The Influence of Splenectomy and Anesthetics on the Nonspecific Complement Fixation Sometimes Shown by Normal Rabbit and Dog Sera, by J. A. Kolmer and R. M. Pearce (pp. 32–45); (4) The Relation of Serum Lipoids and Proteins to Nonspecific Complement Fixation with Normal Rabbit and Dog Sera, by J. A. Kolmer (pp. 46–63); and (5) The Effect of Heat on Normal Rabbit and Dog Sera in Relation to Antilytic and Nonspecific Complement-Fixation Reactions, by J. A. Kolmer and Mary E. Trist (pp. 64–87).

It is indicated that the sera of rabbits which are intended for use in complement-fixation tests should be tested several times before the animals are inoculated, preferably with the particular antigen to be used, and only those selected that react negatively. It is further emphasized that great caution

should be employed in the interpretation of complement-fixation tests with dog serum.

It is concluded that the nonspecific complement fixation by normal rabbit and dog sera is probably due primarily to thermolabile and thermostabile antilytic (anticomplementary) substances in the sera.

The dialysis method for the determination of pregnancy in animals, with special reference to the sources of error, M. KAHN (*Arch. Wiss. u. Prakt. Tierheilk., 41 (1915), No. 3, pp. 222–243*).—The importance and value of an early diagnosis of pregnancy and the difficulty of determining such a condition by a purely physical examination is pointed out. The theory of the origin and mechanism of the defensive ferments produced by the parenteral introduction of foreign protein into the animal organism is also discussed, and the technique of the method, including the preliminary testing of the dialyzation tubes, preparation of the placental tissue, etc., is described in detail.

From experimental data it is concluded that the dialysis reaction can be used for the diagnosis of pregnancy in horses and cattle from the first month to full term, using the technique as described. Only such results as are obtained with hemoglobin-free perfectly clear serum, properly prepared placental substrate, and standardized tubes can be considered as trustworthy.

The serum of nonpregnant mares and of geldings persistently showed a negative reaction. The same results were obtained with cattle.

Special attention is called to the fact that the prepared placental tissue of the horse could not, in some instances, be used after 24 hours unless again freed from ninhydrin reacting substances by boiling in distilled water. The importance of using dialyzation tubes which are impermeable to protein yet permeable to peptones, and which have been carefully standardized, is also emphasized.

Oleander poisoning (*Ztschr. Veterinärk., 27 (1915), No. 12, pp. 366, 367*).—Two cases of poisoning in horses, resulting in death and attributed to the eating of oleander leaves, are reported.

The animals first refused food and soon became unable to stand. On examination the pulse was found to be weak, the heart sounds indistinct, the conjunctiva congested, respiration labored, peristalsis suppressed, and fever present. On post-mortem no visible pathological changes except a small clot in the heart cavity of one of the animals were evident. The stomach and intestinal contents revealed the presence of fresh green leaves, later identified as oleander leaves.

See also a previous note by Wilson (E. S. R., 21, p. 681).

The use of medicaments in the treatment of diseases caused by nematodes, A. RAILLIET (*Rev. Méd. Vét., 91 (1915), No. 15, pp. 490–513*).—A summarized account. See also a previous note (E. S. R., 34, p. 576).

Comparative tests of the action of certain common disinfectants, A. KRUPSKI (*Schweiz. Arch. Tierheilk., 57 (1915), No. 12, pp. 615–651, figs. 5*).—Experimental data obtained from comparative tests of a number of disinfectants are submitted. The results are in part represented graphically.

It is indicated that in general the cresol emulsions best fulfill the chief requirements, viz, cheapness and bactericidal strength, of an efficient disinfectant.

The disinfection of infected wood, E. FLEISCHER (*Wiener Tierärztl. Monatsschr., 2 (1915), No. 11, pp. 497–507*).—As the result of an investigation to determine the value of various agents for the disinfection of wood the author has demonstrated that stronger solutions of the disinfectants are necessary in actual practice than were found to be satisfactory in the experi-

mental tests. The materials used were lime, bleaching powder, potassium hydroxid, antiformin, formaldehyde, and mercuric chlorid. All were found to be satisfactory in proper concentrations. The organisms used were the anthrax, swine plague, and chicken cholera bacilli.

It is concluded that under the experimental conditions a 2.5 per cent solution of formaldehyde is the most reliable disinfectant, even in the presence of anthrax spores.

A bibliography of some 30 references is appended.

A contribution to the evaluation of methods for the bacteriological and serological diagnosis of anthrax with special reference to the microscopical investigation, W. PFEILER and G. SCHEYER (*Berlin. Tierärztl. Wchnschr., 32 (1916), No. 3, pp. 25–30*).—The authors discuss the various methods used in staining the anthrax bacillus, and indicate those stains which have been found to give the most satisfactory results. The results of 315 examinations of pathological specimens, comprising 113 cases in cattle, 8 in the horse, 4 in sheep, and 190 in swine, are reported in tabular form and briefly discussed. The precipitin reaction, microscopical examination, and culture and animal inoculation were the methods used in diagnosing the cases reported.

A bacteriological study of methods for the disinfection of hides infected with anthrax spores, F. W. TILLEY (*Jour. Amer. Leather Chem. Assoc., 11 (1916), No. 3, pp. 131–169*).—This is a slightly abridged account of the investigation previously noted (E. S. R., 33, p. 178).

The biology of pseudoanthrax bacilli.—Contribution to the differential diagnosis of anthrax and pseudoanthrax bacilli, N. POKSCHISCHEWSKY (*Arb. K. Gsndhtsamt., 47 (1914), No. 4, pp. 541–590, pls. 4*).—This paper, substantially noted from another source (E. S. R., 33, p. 579), includes a three-page bibliography.

Foot-and-mouth disease, L. NEVERMANN (*Arch. Wiss. u. Prakt. Tierheilk., 41 (1915), No. 3, pp. 177–210, pls. 2*).—The serious outbreaks in Germany and the means used in handling such epizootics are reviewed. Methods of control are considered under three divisions (1) the slaughter of infected animals, (2) quarantine measures, and (3) immunization.

Experimental results of immunization tests with Loeffler's protective serum obtained from different localities are presented in tabular form. From these results it is concluded that the injection of large doses (100 to 200 cc.) of the antiserum is not only a means of protection but is also of value as a therapeutic agent in treating animals affected with the disease. The injection of small doses of serum yielded unsatisfactory results.

Aphthous fever, E. LECLAINCHE (*Rev. Gén. Méd. Vét., 24 (1915), No. 281–282, pp. 201–210*).—The author reports that immunization against aphthous fever with antiserum does not give good results and is in general unreliable. Strict quarantine measures are indicated as being the most satisfactory means of combating the disease. All diseased and infected animals should be slaughtered and the infected district policed.

The "double zone system" of quarantine has given excellent results.

Foot-and-mouth disease, R. GRAHAM (*Kentucky Col. Agr., Ext. Div. Circ. 28 (1914), pp. 3–8, figs. 5*).—A brief popular account furnishing information for the farmer.

Preliminary report on the conglutination test with special reference to the diagnosis of glanders, C. P. FITCH (*Jour. Amer. Vet. Med. Assoc., 48 (1916), No. 5, pp. 566–574*).—From the results obtained in testing over 300 horses by the conglutination, complement fixation, and agglutination reactions it is concluded that the complement fixation and conglutination tests are in many respects very similar. While both are relatively complex the reagents

for conglutination are more easily obtained than for complement fixation. The greater sensitiveness of the conglutination system, however, offsets this advantage.

The conglutination reaction has a decided advantage over complement fixation for the diagnosis of glanders in asses, mules, and those horses which have anticomplementary substances in their blood. No single sera test is deemed absolute for the diagnosis of glanders. The necessity of standardized methods for carrying out such diagnostic tests in various laboratories is emphasized, as tending to reduce the number of discrepancies in the results obtained by different workers.

The mallein conjunctival test, J. MAREK (*Deut. Tierärztl. Wchnschr., 24 (1916), No. 5, pp. 43–48, figs. 4*).—The author reviews in detail the technique of the mallein ophthalmic test for glanders and discusses certain procedures which have yielded the best results. The interpretation of results is also considered.

Prophylaxis of glanders, V. DROUIN (*Rev. Gén. Méd. Vét., 24 (1915), No. 281–282, pp. 210–226*).—The author reviews the subject in general and indicates the value of the subcutaneous mallein and ophthalmic reactions in the diagnosis of the disease. The complement fixation reaction is also recommended, but it is not deemed so valuable as the other diagnostic tests. In using these tests it is important to consider all symptoms in order to form a correct judgment for the diagnosis.

The usual sanitary measures should be observed and diseased horses slaughtered.

Excellent results have been obtained by the systematic subcutaneous use of mallein.

Administrative control of glanders, E. B. ACKERMAN (*Dept. Health N. Y. City, Reprint Ser., No. 16 (1914), pp. 13*).—This is a report of control work in New York City.

A case of tetanus favorably treated with magnesium glycerophosphate, SITTIG (*Ztschr. Veterinärk., 27 (1915), No. 12, p. 368*).—After two subcutaneous injections of tetanus antitoxin without any favorable result, 50 cc. of a 25 per cent sterile solution of magnesium glycerophosphate was injected intramuscularly into a horse. The injection was repeated on the following day. The results of this treatment were most striking and prompt.

It is indicated that magnesium glycerophosphate is an excellent antitetanic even in the severest cases of the disease.

A preliminary report on the pathology of bovine actinomycosis, F. GRIFFITH (*Rpts. Local Govt. Bd. [Gt. Brit.], Pub. Health and Med Subjs., n. ser., No. 107 (1915), pp. 11*).—This preliminary report deals with 50 frozen tongues and lymphatic glands from the lingual region, of which 46 were imported from Argentina, 2 from North America, and 2 from Siberia, and 44 fresh specimens from animals slaughtered in England. The results show that actinobacillosis is widespread and forms a considerable proportion of the cases of disease in oxen known under the name of actinomycosis.

An account of investigations on the subject by Hope has been previously noted (E. S. R., 31, p. 882).

Contagious abortion in cows, J. W. KALKUS (*Washington Sta. Popular Bul. 94 (1915), pp. 4*).—A brief account of this disease, with preventive and remedial measures.

Studies to diagnose a fatal disease of cattle in the mountainous regions of California, K. F. MEYER (*Jour. Amer. Vet. Med. Assoc., 48 (1916), No. 5, pp. 552–565*).—A preliminary account of work with a disease that occurs in California and Nevada, and which is thought to be bovine hemorrhagic septicemia.

The life history of Gongylonema scutatum, B. H. RANSOM and M. C. HALL (*Jour. Parasitology, 2 (1915), No. 2, pp. 80–86*).—This is a report of studies of the life history of the gullet worm of sheep and cattle, commenced in April, 1911, at which time investigations of the rôle of insects as intermediate hosts of helminths were undertaken.

"The eggs of *G. scutatum* present in the feces of sheep and cattle infested with the adult parasite hatch out when swallowed by insects of various species. The larvæ thus released from the eggs pass into the body cavity and reach the final larval stage in about a month. In this stage the larva is coiled into a spiral and is inclosed in a capsule about 0.5 mm. in diameter. The length of the fully developed larva is about 2 mm. and the esophagus equals about two-thirds the body length. The mouth, elongated dorso-ventrally, is surrounded by a flange-like chitinous border.

"Sheep fed upon insects containing these larvæ became infested with Gongylonema. A hog fed upon Croton bugs artificially infested by feeding with eggs of Gongylonema from cattle failed to become infested. A mouse, rabbit, and guinea pig fed with Gongylonema larvæ from beetles found in sheep manure, or from Croton bugs artificially infested by feeding Gongylonema eggs from cattle, also failed to become infested. Failure to produce infestation in these various animals indicates that the Gongylonema of sheep and cattle (*G. scutatum*) is not transmissible to hogs, mice, rabbits, or guinea pigs.

"Gongylonema larvæ have been found in various species of dung beetles collected from sheep manure, namely, *Aphodius femoralis*, *A. granarius*, *A. fimentarius*, *A. coloradensis*, *A. vittatus*, *Onthophagus hecate*, and *O. pennsylvanicus*. They have been developed in various species of Aphodius and in Croton bugs (*Ectobia germanica*) by feeding the eggs of *G. scutatum* from cattle. The feeding of eggs of Gongylonema from the gullet of a hog (presumably *G. pulchrum*) to Croton bugs also resulted in the development to encysted larvæ.

"Under natural conditions the usual intermediate hosts of *G. scutatum* are probably dung beetles of various species.

"The life history of *G. scutatum* is similar to that of *G. neoplasticum* of rats, mice, and other rodents, the intermediate stage of the latter having been found by Fibiger and Ditlevsen to develop in roaches (*Periplaneta americana*, *P. orientalis*, and *B. germanica*) and in a beetle (*Tenebrio molitor*). It is also similar to that of another rat and mouse parasite, *Spiroptera obtusa*, whose intermediate host was found by Leuckart and Marchi to be the larva of a beetle (*T. molitor*)."

Report of the veterinary department, R. A. CRAIG (*Indiana Sta. Rpt. 1915, pp. 70–75*).—Three commercial hog-cholera remedies were tested and found to possess absolutely no preventive or curative properties.

The effect of heat on the potency of antihog-cholera serum was investigated, with the result that the serum was found still to be potent after being heated for one hour at 58° C. An attempt was made to prepare a vaccine by mixing hog-cholera blood and antihog-cholera serum and heating in a water bath. This, however, failed to protect pigs, thus evidently conferring no immunity.

The virulence of blood from cholera hogs was tested at different periods in the disease by making tail bleedings in from 5 to 8 days from the date of inoculation. Eight-day virus was found to kill pigs in about 13 days, as compared to pen exposure, which killed in 24 days.

The continued attempts to isolate a specific micro-organism from the hog-cholera blood and blood filtrates were unsuccessful.

On Blepharocorys equi sp. nov., a new ciliate from the cecum of the horse, I. C. SCHUMACHER (*Univ. Cal. Pubs., Zool., 16 (1915), No. 8, pp. 95–106, pl. 1*).—

This paper deals with the morphology of a new species, which is compared with the closely allied forms previously described.

Remarks on the diseases of foxes, I. E. CROKEN (*Amer. Jour. Vet. Med., 11 (1916), No. 3, pp. 195–197*).—A brief discussion of diseases of foxes, based upon the author's experience in Prince Edward Island where fox farming is carried on on a very large scale.

Practical application of the agglutination test, R. JONES (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 2 (1915), No. 3, pp. 22, 23*).—The practical application of this test on commercial farms in Connecticut was taken up in June, 1914, and continued until April, 1915, during which time 70 farms in 40 different cities and towns were visited and 14,609 birds tested.

The average infection for all flocks was 10 per cent, but the range was very great, running from none in the case of a few flocks to 56.3 per cent in the worst flock. That the lowest percentage of infection was found in the Leghorns is accounted for only by the natural resistance due to the activity and vitality of the breed. The hatchability of eggs and mortality of chicks seems to depend upon the size and vitality of the birds.

See also a previous note by F. S. Jones (E. S. R., 28, p. 887).

Suggestions to poultrymen concerning chicken pox, J. R. BEACH (*California Sta. Circ. 145 (1915), pp. 8, figs. 5*).—This circular deals particularly with preventive vaccination, with an announcement concerning the sale of vaccine by the university.

RURAL ENGINEERING.

Irrigation in the United States, R. P. TEELE (*New York and London: D. Appleton & Co., 1915, pp. IX+253, figs. 2*).—This book presents a nontechnical discussion of the legal, economic, and financial aspects of irrigation in the western United States, with chapters on the field for irrigation in the United States, historical information, climatic conditions in the arid region, water supply, crops, legislation relating to irrigation, irrigation investments, organization and operation of irrigation enterprises, and the present situation and future of irrigation in the United States.

The greater part of the book is devoted to a discussion of federal and state legislation relating to irrigation, irrigation investments, and organization and operation of irrigation enterprises. In these chapters the author has attempted to set forth, for the prospective investor in irrigated lands, water rights, irrigation bonds, stocks, etc., the exact nature of what is being offered to investors, particularly as to the security behind such investments.

The author expresses his belief in the feasibility of irrigation and in the possibilities of the West, but he points out that the interests of the West can not be advanced permanently by overstating the returns which are to be secured from irrigated lands or from securities behind irrigation investments. It is pointed out further that to-day large areas of land exist under projects either completed or under construction not yet under cultivation and irrigation, and with no effective demand for this land. "As it stands to-day, few, if any, of such enterprises, public or private, are paying any return on the capital invested. The great need of the West now is the utilization of the works already built, not more works. . . . Past experience and the present situation seem to indicate that irrigated lands can not be expected to repay directly the cost of irrigation works, with interest, as is ordinarily expected of investments generally. Past experience demonstrates, however, that if the loss to original investors is overlooked, irrigation has been a decided success."

To relieve the situation a system of local, state, and federal aid is favored by the author, the general features of which are suggested as follows: "(1) Provision for the segregation for reclamation of tracts of public land as is now done under the Carey Act; (2) provision for the reclamation of similar tracts of state or private lands, or of tracts partly public and partly private; (3) provision for the creation of districts composed of such lands, in general like the present irrigation districts; (4) provisions for the submission of proposals for the creation of such districts and the construction of works to supply the lands with water in somewhat the same manner as Carey Act proposals are now submitted; (5) provision for the approval of such proposals by all the contributing agencies and for the pledging of these agencies to contribute the amounts agreed upon; (6) provision for the issue of bonds which shall be made in lien on the lands of the districts to be enforced by taxation as is now done in irrigation districts; (7) provision for the disposal of lands to settlers subject to the bonds issued to secure funds for construction; and (8) provision for the enforcement of the lien on the land in case there is default in the payment of interest or principal."

Irrigation possibilities in Kansas, H. B. WALKER (*Biennial Rpt. Kans. Bd. Agr., 19 (1913–14), pp. 307–316, figs. 5*).—The author emphasizes the importance of first developing the areas of Kansas in which water may be obtained for irrigation by pumping from relatively small depths, and is of the opinion that farming methods, to utilize the available water supplies most economically, should be intensive.

Irrigation by pumping in Kansas: What Kansas is doing to develop irrigation, B. P. WALKER (*Biennial Rpt. Kans. Bd. Agr., 19 (1913–14), pp. 301–306, fig. 1*).—This is a brief sketch of the irrigation situation in Kansas.

[Alfalfa irrigation experiments] (*New Mexico Sta. Rpt. 1915, pp. 45–49, fig. 1*).—The amounts of water applied in irrigation experiments on 46 plats of alfalfa, conducted in cooperation with the Irrigation Investigations of this Department, are reported in tabular form. The plats varied in area from 1,980 to 14,040 sq. ft. An average of 0.38 acre-feet per acre per irrigation was applied to the first 28 plats and of 0.504 acre-feet per acre per irrigation to the remainder. Five irrigations were made. From the irrigation standpoint the results were deemed unsatisfactory.

Tests of a proportional weir (*Engin. News, 74 (1915), No. 22, pp. 1018, 1019, figs. 3*).—Tests of two proportional-flow weirs of the Retiger type (E. S. R., 31, p. 784) are reported, both being 3½ ft. long on the crest, but differing in height from the crest to the curve of the side.

The results as graphically reported indicate the approximate proportionality of discharge to head. For the higher heads (above 1 ft.), the coefficients of the smaller weir are about 2.4 per cent higher than for the larger weir. The gradual increase in coefficient as the head increased was found to be not due to velocity of approach.

Report of the acting commissioner for water conservation and irrigation for the year ended June 30, 1915, H. H. DARE (*Rpt. Act. Comr. Water Conserv. and Irrig. [N. S. Wales], 1914–15, pp. 109, pls. 16*).—This report covers the physical and financial status of established and projected irrigation schemes and the extent of artesian and shallow boring during the year from July 1, 1914, to June 30, 1915. Private works for the conservation and distribution of water for irrigation and stock watering purposes are also reported upon.

Annual report of the Water Supply Commission of Pennsylvania, 1914 (*Ann. Rpt. Water Supply Com. Penn., 1914, pp. 114+399, pls. 34*).—This reports the activities of the commission for 1914 and contains considerable hydro-

graphic data. An appendix gives the results of measurements of stream flow in the State in 1914.

Ground water in Lasalle and McMullen counties, Texas, A. DEUSSEN and R. B. DOLE (*U. S. Geol. Survey, Water-Supply Paper 375–G (1916), pp. 141–177, pls. 2, fig. 1*).—This report describes the geology, physiography, and water bearing formations of two areas of 1,180 and 1,707 square miles in southwestern Texas, and presents the results of an investigation of the ground waters of the areas with reference to their use for irrigation and domestic purposes.

Data from 131 wells in the two counties, together with analyses of the waters, are reported. These are taken to indicate "that strongly mineralized alkali waters abound in Lasalle and McMullen counties. Almost all the waters tested exceed 500 parts per million in total mineral content, and nearly two-thirds of them exceed 2,000 parts. Sulphate and chlorid waters predominate. Though only about one-quarter of the supplies are classed as sodium carbonate, more than half contain notable amounts of black alkali. Because of this generally excessive mineral content a large proportion of the waters are poor supplies, many being unfit for use. Drinkable waters have been found in many places, and a few are only moderately high in mineral content. In general, however, the region affords supplies carrying excessive contents of alkali. The waters must be called poor for use in boilers, because they would cause excessive foaming, though they would probably not be corrosive nor would they form much scale. The content of alkali of most of them is too great to render it advisable to irrigate with them, and many are unfit for such use."

A water-power reconnoissance in south-central Alaska, C. E. ELLSWORTH and R. W. DAVENPORT (*U. S. Geol. Survey, Water-Supply Paper 372 (1915), pp. 173, pls. 22, figs. 6*).—This reports in convenient form data on measurements of the volume of streams in the Bering River basin; the Controller Bay region; the basin of the lower Copper River and its principal tributary, the Chitina; in numerous localities in the Prince William Sound region; the Willow Creek district; and the eastern part of the Kenai Peninsula, together with compilations of the precipitation records made by the Weather Bureau of this Department. A separate report on a water-power reconnoissance in southeastern Alaska in 1909, by J. C. Hoyt, is appended.

Geo-hydrological studies and research in Italy in connection with agriculture, G. DE ANGELIS D'OSSAT (*Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 4, pp. 517–521*).—The importance of the geologist in connection with drainage and irrigation work, in soil study, and in obtaining rural water supplies is pointed out, with reference to Italian rural conditions.

A bibliography of Italian literature bearing on the subject is appended.

Monograph on the irrigation wells of the Jaunpur District, A. C. WALKER (*Dept. Land Rec. and Agr. United Prov. Agra and Oudh, Agr. Ser., Bul. 32 (1915), pp. 56*).—This describes the wells and well irrigation in the district.

The peat resources of Wisconsin, F. W. HUELS (*Wis. Geol. and Nat. Hist. Survey Bul. 45 (1915), Econ. Ser. 20, pp. XVII+274, pls. 22, figs. 20*).—A general discussion of the origin, characteristics, and uses of peat is followed by a report of investigations into the location, extent, and character of the peat beds of Wisconsin by counties and the possibilities for their economic utilization.

Wisconsin is considered to have extensive peat resources, but it is stated that attempts at the development of peat industries in the State have been unsatisfactory. "The peat lands of Wisconsin in a number of instances are much more likely to be drained and reclaimed for agricultural purposes than they are to be used for their potential fuel value."

Cement and its manifold uses, E. A. TREGO (*Biem. Rpt. Kans. Bd. Agr., 19 (1913–14), pp. 448–457, figs. 10*).—Several of the uses of cement in farm structures are described and illustrated.

Effect of iron and calcium on concrete sand, T. SAVILLE (*Engin. News, 74 (1915), No. 26, p. 1242, figs. 2*).—In connection with a study of New Hampshire and Vermont sands and gravels, it was found that sands containing iron particles made a stronger mortar than ordinary sand, and sand containing considerable calcium carbonate made mortars stronger than those made from standard Ottawa sand.

Shrinkage and time effects in reinforced concrete, F. R. MCMILLAN (*Univ. Minn. Studies Engin., No. 3 (1915), pp. 41, pls. 3, figs. 17*).—Tests of long duration under load on a 5½ by 30 in. by 12 ft. reinforced concrete beam of 1:2:4 mixture, four 4 by 5 by 42 in. reinforced concrete beams of 1:2:4 mixture, a 6 by 8 ft. concrete slab reinforced two ways and of 1:2½:4 mixture, and a 10 by 10 ft. concrete slab reinforced one way and of 1:2:4 mixture, are reported, together with a test of three beams to determine the shrinkage under variable conditions of curing.

"With materials and mixtures as used in these tests it is safe to predict a shrinkage of from ¾ to 1 in. or more in 100 ft. when exposed to the ordinary dry air of a heated building. It can not be definitely stated when shrinkage will cease under these conditions, but certainly not within a year. However, from one-half to two-thirds of the amount indicated may be expected within 40 to 60 days after exposure to dry air. The effect of thorough wetting in the early curing stage seems to have no effect in reducing the total shrinkage, the only effect being to retard the beginning of the action, this in spite of the fact that the strength of the concrete is materially increased by this treatment. Slight changes in the moisture content in the air will retard the shrinkage or even cause a swelling, which seems to warrant the belief that structures open to the elements would never show the same total shrinkage as found in these tests.

"The continued shrinkage in beams and slabs acts to produce an increasing deflection, though not to the same extent as the time yielding. The yielding of the concrete under compressive stress with time . . . is greater as the unit stress is greater and seems to go on indefinitely. In these tests the deformation due to yielding was found to be from three to five times that produced immediately upon the application of the load. On the tension side of a beam or slab the effect of time is to cause a gradual increase in the steel stress from the breaking down of the concrete in tension or the failure of the bond. The combination of the extension at the bottom and a shortening at the top produces in beams and slabs a continually increasing deflection. With the same unit changes top and bottom the deflection is less the deeper the beam."

The most important possibility indicated by these tests is considered to be that of the production of high stresses in the longitudinal steel of compression members. "The time yielding of the concrete under stress, combined with the excessive shortening due to shrinkage, may result in deformations from five to fifteen times those expected from the ordinary calculations."

Hydrated lime in concrete road construction (*Good Roads, 48 (1915), No. 23, pp. 305–308, figs. 7*).—This is a review of some of the work done with hydrated lime in concrete pavement construction. The consensus of opinion based on these service tests seems in general to favor the use of hydrated lime on concrete roads.

Apparatus for measuring the wear of concrete roads, A. T. GOLDBECK (*U. S. Dept. Agr., Jour. Agr. Research, 5 ('916), No. 20, pp. 951–954, pl. 1, fig. 1*).—An instrument developed by the author in the Office of Public Roads and Rural

Engineering of this Department for measuring the wear of concrete roads is described in detail and illustrated. It "essentially consists of a fine wire stretched tightly across the road at a constant height, together with an inside micrometer for measuring the distance from the road surface to the wire. Measurements taken 1 ft. apart across the road permit the plotting of its cross section, and if these measurements are repeated at long intervals the change of cross section or the decrease in the thickness of the road will be revealed."

Public highways: Kansas roads, past, present, and future, W. S. GEARHART (*Biennial Rpt. Kans. Bd. Agr., 19 (1913–14), pp. 56–120, figs. 38*).—This article points out the benefits of good roads to Kansas farmers, and discusses in some detail the location, design, construction, maintenance, and financing of the different types of roads in Kansas.

Economic factors all important in rural highways, L. W. PAGE (*Engin. Rec., 72 (1915), No. 13, p. 385, fig. 1*).—The principal factors which affect the economic efficiency of an improved road, and upon which it is thought economic comparisons should be based, are discussed as cost of construction and maintenance, amount and character of traffic, and the average unit cost of hauling before and after the improvement is made. With special reference to the last factor, it is stated that "if the improvement is to be justified economically [the] total annual saving must be sufficient, after all costs for maintenance and repairs are deducted, to pay a reasonable interest on the original investment. . . . The State is much better circumstanced for planning and supervising road improvement work than are any of its political subdivisions."

A chart is shown which is intended to illustrate the scope of a model state organization. See also a note of a previous report along similar lines by Pennypacker (E. S. R., 33, p. 290).

Effects of varying mixture and ignition timing, V. R. GAGE (*Power, 42 (1915), No. 21, pp. 720–722, figs. 2*).—Indicator diagrams obtained from a 6-horsepower, 4-stroke cycle, hit-and-miss governed internal combustion engine, operating on different fuel mixtures and with the spark retarded or advanced, are given. These show that "not only maximum economy but also maximum power are obtained by adjusting the engine to run on as lean a mixture as possible, with the spark advanced only enough to overcome the lapse of time required for the mixture to burn and to overcome the electrical lag."

The Highland Society's exhibition trial of motor tillage implements at Stirling (*Impl. and Mach. Rev., 41 (1915), No. 488, pp. 926, 927*).—Trials of four tractor plowing outfits and one motor plow on uniform stiff clay soil and light soil, with grades varying from 1 in 7 to 1 in 30, are reported, in which it was attempted to simulate actual working conditions on the farm. It was required, however, that "the depth of furrow shall be not less than 8 in. and not more than 10 in. on the light land and not less than 6 in. on the stiff land."

It was found that "none of the tractors was successful in ascending the gradient on the plats originally assigned to them on the light land and had to be removed to a part of the field where the gradient was less severe. The presence of a liberal dressing of fresh manure on the surface added to the difficulty." It was concluded that the tractors are unable to do field work on a grade exceeding 1 in 20. Under the favorable weather conditions prevailing during the trials no appreciable packing by the wheels of the tractors was observed.

Test of a potato planter and coverer, A. NACHTWEH and K. VORMFELDE (*Mitt. Verb. Landw. Masch. Prüfungsanst., 9 (1915), No. 1, pp. 1–9, figs. 5*).—A two-row potato planter is described and diagrammatically illustrated, and tests are reported. The main feature of the planter is a traveling cup chain which lifts

a potato in each cup and drops it into a tube through which it passes into the furrow. The furrow is dug ahead of the seeder and the seed is covered by a pair of inclined disks.

In the tests it was found that on the average about ¼ hectare (0.61 acre) could be planted in an hour in a field 250 meters (820 ft.) long. No injury to the seed was observed. While it is concluded that such a planter is practical and useful, it is estimated that on a field of 15 hectares (37 acres) the costs of machine and hand planting will be about the same. It is thought probable, however, that a three- or four-row machine of this type on a larger field would cause considerable saving.

Points on the selection, adjustment, and care of farm machines, E. M. D. BRACKEE (*Oregon Sta. Bul. 133 (1915), pp. 48, figs. 37*).—This is a popular discussion intended for the farmer and dealing in detail with factors relating to the selection of farm machines, types and adjustments of farm machines, and the care of farm machinery. A number of practical illustrations and other data are included.

The dairy barn and milk house, how to construct them, R. E. HUNDERTMARK and A. B. NYSTROM (*Washington Sta. Popular Bul. 95 (1915), pp. 40, figs. 22*).—This bulletin describes and illustrates the shed, open shed, bank, and two-story types of dairy barn, and a convenient milk house, all of which are considered suitable for Washington conditions, and gives instructions as to design and construction, together with bills of materials.

The construction of shearing sheds and yards, compiled by J. W. MATHEWS (*Dept. Agr. N. S. Wales, Farmers' Bul. 91 (1915), pp. 29, figs. 17*).—This bulletin describes and illustrates two sheep-shearing sheds, a combined shearing shed and grain store, and sheep yards for small flocks, and points out the factors to be considered in their planning.

Housing farm poultry, A. G. PHILIPS (*Bien. Rpt. Kans. Bd. Agr., 19 (1913–14), pp. 656–669, figs. 21*).—The substance of this article has been noted from another source (E. S. R., 27, p. 374).

Planning the farm in relation to the farmstead, J. B. DAVIDSON (*Bien. Rpt. Kans. Bd. Agr., 19 (1913–14), pp. 358–360, fig. 1*).—The author offers a sketch showing the routes to be traveled in performing the farm operations, this to serve as a basis for the best location of farm buildings, roads to the field, fences, etc.

Household conveniences and how to make them, C. E. HANSON and E. J. FERMIER (*Texas Agr. Col. Ext. Serv. Bul. B. 8 (1915), pp. 27, figs. 14*).—This bulletin describes and illustrates cold water and hot and cold water supply systems, a fireless cooker, evaporation cooler, cold box, fly traps and screen frames, ironing board, and kitchen wall cabinet.

Saving fuel in heating a house, L. P. BRECKENRIDGE and S. B. FLAGG (*U. S. Dept. Int. Bur. Mines Tech. Paper 97 (1915), pp. 35, figs. 3*).—This bulletin describes the different fuels used and methods for heating residences, discusses factors affecting the design of heating apparatus and governing the consumption of fuel and the convenience of operation, and gives general suggestions on the firing of different fuels, together with the results of house heating tests obtained from various sources. The most important points brought out in this study are as follows:

"... Both convenience of operation [in heating a house] and consumption of fuel depend on the system of heating (and ventilation) installed, and convenience, fuel consumption, and first cost should be considered in making a selection. The heater should be large enough to meet continuously and without attention for periods of eight hours the demands for heat in all weather except the most severe.

"Heating equipment that burns satisfactorily and economically one kind or size of fuel may not be well adapted to burning another. Ascertain by experiment what fuel and what method of using it are best suited to [the] needs. . . .

"Attend to the fire regularly and try to anticipate the demands for heat. Keep the heat-absorbing surfaces of the heater free from soot and dust by regular cleaning. Heating systems often fail to meet the demand for heat in severe weather because of insufficient draft. To supply additional heat, the heater must be able to burn more coal. The more probable causes of insufficient draft are chimney not high enough, or having its top too near some tall object; chimney, smoke pipe, or gas passages of heater clogged with soot or débris, sometimes through the breaking of a partition between two flues in a chimney; leaky connection of smoke pipe to heater or to chimney; accidental closing of hand damper in smoke pipe; clogging of fuel bed by clinkers; and too great a length of horizontal smoke pipe between the heater and the chimney."

A list of available publications issued by the Bureau of Mines on fuel technology is included.

Water supply, plumbing, and sewage disposal for country homes, R. W. TRULLINGER (*Bien. Rpt. Kans. Bd. Agr., 19 (1913–14), pp. 361–413, figs. 38*).—The substance of this article has been noted from another source (E. S. R., 30, p. 690).

Rural sanitation, C. A. MAGOON (*Washington Sta. Popular Bul. 93 (1915), pp. 60, figs. 30*).—This bulletin takes up the subject mainly from the bacteriological viewpoint, giving considerable information as to the protection of foods, water supplies, and dairy products, and describing briefly methods of well protection and sewage and garbage disposal.

A method of treatment of polluted farm water supplies with chlorid of lime is outlined as follows: "One tablespoonful of the chlorid of lime is dissolved in 10 qt. of water. This quantity is sufficient to treat 1,000 gal. of water and the operation is carried out by simply pouring the clear solution into the water to be treated and stirring thoroughly. This solution is a powerful germicide and its action is very rapid, ten minutes or so being all the time required to carry out the purification."

Disposal of human excreta and sewage of the country home, T. HORTON (*Mo. Bul. N. Y. State Dept. Health, 31 (1915), Nos. 8, pp. 237–243, figs. 2; 11, pp. 333–339, figs. 4*).—It is stated that as the main requirements a sanitary sewage disposal system for a country home should not be a nuisance, a menace to health, nor the source of an esthetic objection. Its operation should not be affected by freezing weather and it should be convenient. On the basis of these requirements two dry-earth privies, one with a vault and the other with a removable container; two types of cesspools; and a settling tank and tile absorption system, are described and illustrated.

The disposal of household wastes, W. P. GERHARD (*New York: D. Van Nostrand Co., 1915, 3. ed., pp. 195, figs. 4*).—This book discusses the disposal of sewage, garbage, and ashes, chiefly from the farmer's and householder's point of view.

RURAL ECONOMICS.

Constructive rural sociology, J. M. GILLETTE (*New York: Sturgis & Walton Co., 1916, new ed., rev. and enl., pp. XIX+408, figs. 8*).—This is a revised edition of the book previously noted (E. S. R., 28, p. 595). It contains an additional chapter on the physical condition of the United States and agriculture, and a number of new topics under the individual chapters. The material has been

slightly revised and brought up to date by the use of more recent data furnished by the 1910 Census.

Germany's food supply, W. J. ASHLEY (*Quart. Rev., 224 (1915) No. 445, pp. 444-462*).—This article points out the source of various products going to make up Germany's food supply, and the influence of the war in changing the quantity of the products. The author believes the effect will have a greater influence upon the supply of live stock, and therefore on the meat and dairy products, than upon other agricultural products, since the larger proportion of the crops will be consumed direct without being transformed into milk or meat.

Permanent agriculture and social welfare, T. F. HUNT (*U. S. Senate, 64. Cong., 1. Sess., Doc. 239, pp. 8*).—This address, delivered in 1915 before the National Association of Real Estate Exchanges at Los Angeles, and before the Farm Management Association at the University of California, presents the following propositions:

(1) American farms must be recapitalized at least three times in a century. (2) The open country can not afford to support numerous social, religious, or racial divisions. (3) The country population of one generation determines the character of the city population in the next generation. (4) Land credit, popularly known as rural credit, is a means of creating a permanent agriculture by putting farm mortgages on an investment basis.

The author also states that farming is the one great industrial occupation in the United States where children are of economic advantage and that training which children obtain in thus contributing to the family income is a factor of great importance to society. In the long run it is of no particular advantage to any person to own a farm unless he intends to raise thereon a successful family. With these propositions as a basis he argues that there should be established a type of rural credit that will tend toward a great stability in the rural population through enabling the young men with but small means to purchase a farm and to pay for it through a long series of years.

Grain farming in the corn belt with live stock as a side line, C. VROOMAN (*U. S. Dept. Agr., Farmers' Bul. 704 (1916), pp. 48, figs. 5*).—The author, writing from the standpoint of the farmer farming for a living, states that to make a money-maker of a farm that has become a losing proposition through steady grain farming, in addition to raising standard grain crops it is necessary to grow legumes, raise live stock as a side line, keep accounts of receipts and expenditures, "mix horse sense with scientific agriculture, thus adapting the new methods to changes in market, weather, and other conditions," try to secure enough capital, pursue a consistent policy, confer with the county agent, and study other available information.

Specific suggestions along these lines are given.

Chemung County, an account of its agriculture and of its farm bureau, M. E. CHUBBUCK and G. P. SCOVILLE (*Farm Burs. N. Y. Circ. 7 (1915), pp. 38, pls. 4, figs. 2*).—This circular in the main consists of a report of the farm management surveys made by the county agent. The farms have been divided into two classes, called the hill and valley farms, and the data gathered extend over several years.

The authors conclude that neither the size of business, crop yields, quality of live stock, nor diversity of business, alone, is the determining condition in the success of a farm. Size is perhaps the most important factor, but a large business conducted without attention to quality of live stock or diversity of enterprises may result in a loss.

The requirements suggested as necessary for a farm to be as good or better than the average in the county are, for a hill farm, 380 units of size, 26 per

cent of the man work days applied on enterprises other than stock for diversity, milk receipts of $56 per cow, and crop yields of 100 per cent. For the valley farm the corresponding figures are 479 units of size, 37 per cent of man work, 883 of milk receipts, and 100 per cent of crop yield.

The circular also contains a number of suggestions as to methods that may be adopted to improve agriculture in the county, and a brief history of the county agent work from its beginning in 1912.

Farm leases in Iowa, O. G. LLOYD (*Iowa Sta. Bul. 159 (1915) abridged, pp. 30, figs. 5*).—This is an abridged edition of the bulletin previously noted (E. S. R., 34, p. 193).

The American Farm Management Association (*Amer. Farm Management Assoc. Proc., 5 (1914), pp. 95, pls. 2, figs. 4*).—This contains the proceedings of the annual meeting for 1914, including the addresses and reports previously noted (E. S. R., 32, p. 292), and an address entitled Farm Organization Investigations and Their Relation to the Farm Survey, by W. J. Spillman.

The direct marketing of farm produce, B. H. HIBBARD and A. HOBSON (*Hoard's Dairyman, 50 (1916), No. 26, pp. 857, 859–865, figs. 9*).—This article deals primarily with marketing by parcel post, and treats of types, quality, and packing of produce, the establishment of the proper relationship between producer and consumer, rates by parcel post and express, and methods of transacting the business.

Suggestions for parcel post marketing, L. B. FLOHR (*U. S. Dept. Agr., Farmers' Bul. 703 (1916), pp. 19, figs. 8*).—This contains suggestions for persons desiring to sell or buy produce by parcel post, and discusses methods of bringing the producer and consumer into business contact, the parcel post zones, rates, and regulations, methods of conducting the business, and preparing produce for shipment.

Farmers' market bulletin (*North Carolina Sta., Farmers' Market Bul., 3 (1916), No. 14, pp. 22, fig. 1*).—This gives the usual list of farm products for sale, and brief discussions of the market for soy beans, market price of North Carolina corn, and the movement to promote rural credit within the State.

[Agricultural statistics for the United Kingdom, 1900–1914] (*Statis. Abs. United Kingdom, 1900–1914, pp. 94–317*).—These pages contain statistical data for 1900–1914 relative to the average prices of British wheat, barley, and oats in England and Wales in each month, together with the acreage, total production, and average yield of crops and number of live stock for Great Britain and Ireland.

Imports and exports of corn, live stock, and other agricultural produce (*Bd. Agr. and Fisheries [London], Agr. Statis., 49 (1914), No. 4, pp. 276–366*).—This report gives statistical data showing for a series of years the quantity and value of the imports and exports of Great Britain as well as the country of origin or destination.

[Agricultural statistics of Denmark] (*Statis. Aarbog Danmark, 20 (1915), pp. 36–69*).—This yearbook contains information along the lines previously noted (E. S. R., 32, p. 594), adding data for the crop year ended June 30, 1915.

[Agriculture in Chosen] (*Ann. Rpt. Reforms and Prog. Chosen (Korea), 1913–14, pp. 94–165, pl. 1*).—These pages show the extent of agricultural production, the number of live stock, the utilization of water for irrigation, and the work of the experiment and seedling stations and of the Oriental Development Company. This company is organized under government supervision for the encouragement of skilled farmers and others as immigrants, and furnishes them with necessary funds.

A B C of Queensland statistics, 1915, compiled by N. J. MACLEOD (*Brisbane: Govt., 1915, pp. 42*).—This continues data previously noted (E. S. R., 32, p. 288).

AGRICULTURAL EDUCATION.

Annual report of the state director of industrial education to the superintendent of public instruction, 1915, MANETTE A. MYERS (*Ann. Rpt. State Dir. Indus. Ed.* [*N. Mex.*], *2 (1915), pp. 218, figs. 91*).—This report includes a general survey of industrial education in New Mexico, including instruction in agriculture and home economics, an account of the history and organization of boys' and girls' club work in the State, and notes on the progress of instruction in agriculture, home economics, etc., in the schools of the various counties.

Agricultural education, J. E. METZGER (*Md. Agr. Col. Bul., 11 (1914), No. 3, pp. 30, figs. 12*).—This bulletin offers suggestions for school officers and instructors as to courses of study, including an outline of a 4-year course, equipment, laboratory and field work, and community work for agricultural high schools, based on observations made by the author on a tour of the agricultural high schools of Maryland. An appendix gives directions for organizing boys' and girls' agricultural clubs.

[Agricultural instruction in the public schools of New Hampshire], G. H. WHITCHER (*N. H. Dept. Pub. Instr. Inst. Circs. 1913–14, No. 11, pp. 22; 1915–16, Nos. 44, pp. 3; 46, pp. 13, figs. 5; 47, pp. 9, figs. 5*).—These circulars outline instruction in home mixed fertilizers, soils, and agriculture extending through two years for the secondary schools of New Hampshire.

Outlines for high school agriculture, R. K. FARRAR, M. H. HOFFMAN, and A. C. BISHOP (*Des Moines, Iowa: Dept. Pub. Instr., 1915, pp. 154, figs. 113*).—These outlines are for the guidance of superintendents and teachers in organizing and conducting agricultural classes in Iowa high schools.

The one-year course includes studies in farm crops, soils, farm management and rural economics, dairying, horticulture, and farm animals. It comprises 180 lessons arranged in a sequential order and is planned for three recitations and two laboratory periods a week. A seasonal arrangement is also presented. In a suggested distribution of work for a half-year course it is recommended that farm crops and soils be required subjects, with either dairying, horticulture, or farm animals, according to local conditions, as an elective. A minimum price list of apparatus for high school agriculture and a list of reference literature are appended.

Syllabus of a course in agriculture for the use of teachers and students in the high schools of North Dakota, M. C. JAMES, G. W. RANDLETT, and C. C. SCHMIDT (*Bismarck, N. Dak.: Dept. Pub. Instr., pp. 64*).—Part 1 of this pamphlet offers suggestions to teachers on methods of teaching and equipment of libraries and laboratories. Part 2 consists of an outline of a course of study, with references arranged under the topics of the plant, special plants or farm crops, horticulture and forestry, animal husbandry, animal nutrition, the soil, and the farm home and the farm community. Part 3 is a students' laboratary manual comprising 75 exercises.

Farm and school problems for high schools and normals, H. L. GOLL (*Columbus, Ohio: The Heer Press, 1915, pp. XV+538, figs. 102*).—This book contains a scientific discussion of the essential facts in agriculture and an economic study of the factors of greatest influence affecting the various operations of the farm. It comprises four parts, dealing respectively with soils, plants, animals, and farm management, including arithmetical problems, experiments, reference tables, review questions, and lists of publications for reference.

Field and laboratory studies of soils, A. G. MCCALL (*New York: John Wiley & Sons, Inc., 1915, pp. VIII+77, pls. 2, figs. 33*).—This elementary manual con-

sists of 35 exercises in the study of soils, and is intended to furnish sufficient material for the equivalent of one period a week throughout the year.

Fungoid diseases of farm and garden crops, T. MILBURN and E. A. BESSEY (*London and New York: Longmans, Green & Co., 1915, pp. XI+118, figs. 32*).—This book presents for the student and the agriculturist a brief discussion of each of the more important diseases of the common field and garden crops, together with preventive measures. A general explanation of a few botanical terms is included.

The horse in health and disease, F. B. HADLEY (*Philadelphia and London: W. B. Saunders Co., 1915, pp. 261, pl. 1, figs. 69*).—This manual, which is designed as an introductory text to the study of veterinary science in agricultural schools and colleges consists of two parts, dealing respectively with the anatomy and physiology of the horse and with the causes, methods of prevention, and effects of diseases.

Illustrated lecture on the production of clean milk (*U. S. Dept. Agr., States Relations Serv. Syllabus 18 (1915), pp. 18*).—This syllabus, intended for the use of farmers' institutes and other extension lecturers, comprises the following topics: Definition of clean milk, bacteria in milk, sources of milk contamination, importance of clean milk to the consumer and the producer, the cost of milk, how to produce clean milk, scoring dairy farms, transportation, and literature. A list of 49 lantern slides designed to illustrate the lecture and a list of references to literature on the subject are appended.

Elementary domestic science.—II, Foods; advanced cookery, SARAH W. LANDES (*Stillwater, Okla.: Students Supply House, 1915, pp. 187*).—This volume consists of a compilation of recipes. Volume 1 has been previously noted (E. S. R., 22, p. 591).

Home making and home keeping, GRACE J. FERGUSON (*San Juan, P. R.: Dept. Ed., 1915, pp. XI+278, pls. 4, figs. 23*).—This text in the elementary principles and practice of cooking, sewing, laundering, care and feeding of babies and small children, and care of the house has been prepared by the supervisor of home economics for the two-year course in the public schools of Porto Rico. Five 50-minute periods are allowed each week for this study, three of which are to be devoted to cooking and two to sewing. The course for each year is divided into nine sections, one for each school month.

Home management, NEALE S. KNOWLES, LOUISE H. CAMPBELL, and MABEL C. BENTLEY (*Iowa State Col. Agr. Ext. Dept., Home Econ. Bul. 6 (1915–16), pp. 18, figs. 1*).—This is a topical outline for the study of the division of income and care of the home.

[Nature study and elementary agriculture for the elementary schools of New York] (*Cornell Rural School Leaflet, 9 (1915), No. 1, pp. 340, pl. 1, figs. 251*).—This issue for teachers contains subject matter, prepared by specialists in nature study and elementary agriculture, for 1915–16 as outlined in the New York state syllabus for elementary schools. It includes lessons on poultry, horses, cows, calves, and corn; studies of other animals, cultivated plants, and weeds, as well as of birds, insects, and trees; suggestions for the observation of Corn Day; a brief statement of the chief reasons for holding the exhibition of school and home work in agriculture at Cornell University during the farmers' week, and requirements and suggestions for the preparation of the 1916 exhibit; and suggestive material for teachers interested in outdoor study.

[Nature study and agriculture for the elementary schools of New York] (*Cornell Rural School Leaflet, 9 (1915), No. 2, pp. 341–376, figs. 15*).—This issue is for boys and girls and comprises suggestions for the observance of Corn Day and making seed collections, rules for farmers' week exhibit at Cornell University, etc.

Some fundamental propositions for nature-study, M. A. BIGELOW (*Nature-Study Rev., 11 (1915), No. 9, pp. 410–412*).—In the propositions submitted the author defines the scope, aim, and organization of nature study, designating elementary agriculture as a special subdivision of "introduction to science" in grades 7 to 9.

The school garden a laboratory for industrial education, ALICE V. JOYCE (*Nature-Study Rev., 11 (1915), No. 8, pp. 361–364*).—The author suggests how the school garden may be made a laboratory for industrial education, and points out some of its teachings and effects on the pupil.

School gardening in the Philippines, N. H. FOREMAN (*Nature-Study Rev., 11 (1915), No. 8, pp. 356–361*).—The author gives an account of the school and home garden work and its results in the Philippines. This work is centered around the double purpose of giving the pupil a knowledge of plant life and a liking for good wholesome work, and of increasing the quality and quantity of food available for the family. Corn and tree planting campaigns and garden days or small agricultural fairs are important features. Gardening is a prescribed subject in the curriculum of the primary and intermediate schools in the Philippines except in such as are especially organized to give superior training in some one other industrial line.

MISCELLANEOUS.

Annual Report of Idaho Station, 1915 (*Idaho Sta. Bul. 84 (1915), pp. 47*).—This contains the organization list, reports by the director and heads of departments, the experimental features of which are for the most part abstracted elsewhere in this issue, and a financial statement for the fiscal year ended June 30, 1915.

Twenty-eighth Annual Report of Indiana Station, 1915 (*Indiana Sta. Rpt. 1915, pp. 87*).—This contains the organization list, reports of the director and heads of departments, the experimental features of which are for the most part abstracted elsewhere in this issue, and a financial statement for the federal funds for the fiscal year ended June 30, 1915, and for the remaining funds for the period ended September 30, 1915.

Twenty-eighth Annual Report of Michigan Station, 1915 (*Michigan Sta. Rpt. 1915, pp. 187–353, figs. 15*).—This contains reports of the director and heads of departments on the work of the station during the year, the experimental features of which are for the most part abstracted elsewhere in this issue; a financial statement for the fiscal year ended June 30, 1915; reprints of Bulletin 274, Special Bulletins 72 and 73, and Circulars 25–27, all of which have been previously noted; and the text of the principal state legislation relating to the Michigan College and Station and the State Board of Agriculture.

Twenty-sixth Annual Report of New Mexico Station, 1915 (*New Mexico Sta. Rpt. 1915, pp. 81, figs. 4*).—This contains the organization list, a report of the director on the work, publications, and exchanges of the station, including reports of heads of departments, the experimental features of which have been for the most part previously noted or abstracted elsewhere in this issue, and a financial statement for the federal funds for the year ended June 30, 1915.

Twenty-eighth Annual Report of New York Cornell Station, 1915 (*New York Cornell Sta. Rpt. 1915, pp. LXXXIX+1037, pls. 13, figs. 353*).—This contains the organization list, reports of the director of the station and heads of departments, and reprints of Bulletins 283 (revised), and 353–360, Memoirs 5–8, and Circulars 12 (reprint), and 27–31, all of which have been previously noted, and of Bulletin 291 (revised) and 361, abstracted elsewhere in this issue.

Twenty-fifth Annual Report of Washington Station, 1915 (*Washington Sta. Bul. 127 (1915), pp. 59, figs. 15*).—This contains the organization list, a report of the work and publications of the station during the year, and a financial statement for the fiscal year ended June 30, 1915. The experimental work reported is for the most part abstracted elsewhere in this issue.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta., Mo. Bul., 3 (1916), No. 11, pp. 16*).—This number contains brief articles on the following subjects: Good Varieties of Fruits and Vegetables, by J. L. Stahl; Farm Crop Report, by E. B. Stookey (see p. 736); Comparison of Methods of Managing Pullets, and Station Flocks Respond to Special Management, by Mrs. G. R. Shoup (see p. 770); Bee Troubles, by J. W. Ware; and Ground Lime Rock.

Index to Special Bulletins, Volume III, and Paint Bulletins 5 and 6 (*North Dakota Sta., Spec. Bul., vol. 3, Index, pp. 409–416*).

A brief statutory history of the United States Department of Agriculture, F. G. CAFFEY (*Case and Comment, 22 (1916), Nos. 9, pp. 723–733; 10, pp. 850–856, fig. 1*).—This article summarizes the history of this Department and its various activities from a legal standpoint, including a discussion of the constitutionality of the legislation.

Proceedings of the third annual conference of the American Association of Agricultural College Editors, 1915 (*Proc. Amer. Assoc. Agr. Col. Editors, 3 (1915), pp. 62*).—This contains the addresses, reports, and papers given at the third annual conference of this Association, previously noted (E. S. R., 33, p. 496), with a preliminary statement in regard to the first and second conferences.

Ground-levels in democracy, L. H. BAILEY (*Ithaca, N. Y.: Author, 1916, pp. 95*).—This book contains the following material: The Science Spirit in a Democracy (pp. 7–27), the president's address before the American Nature Study Society, December 30, 1915; The Forthcoming Situation in Agricultural Work, I, The Public Foundations (pp. 29–56), II, The Nonpublic Foundations (pp. 57–88), these being respectively the vice-president's addresses before Section M of the American Association for the Advancement of Science previously noted (E. S. R., 32, p. 102; 34, p. 396); and Efficiency and Centralization (pp. 89–95), a part of an address before the Four-State Country Life Conference, February 7, 1916.

Interpolation as a means of approximation to the gamma function for high values of $n!$, R. PEARL (*Science, n. scr., 41 (1915), No. 1057, pp. 506, 507*).—A series of computations is reported, from which it is concluded that "the interpolation method, when third differences are used, gives values slightly better than those by Forsyth's method[a] when $n > 25$. For $n=75$ or more the interpolation method using only second differences gives an approximation sufficiently close for all practical statistical purposes. As to the labor involved, there is no great amount of choice between Forsyth's and the interpolation method, but on the whole there appears to be a distinct, if small, advantage in favor of the interpolation."

The farmers' guide book, C. S. PALMER (*Buffalo, N. Y.: The Hammond Press, 1915, pp. 191*).—This book is intended as "a ready reference book of useful facts and rules for American farming," and contains a wide range of data.

[a] Rpt. Brit. Assoc. Adv. Sci., 1882, p. 47.

NOTES.

Delaware College and Station.—F. B. Hills, assistant professor of animal husbandry and assistant animal husbandman, has resigned to take charge of the publicity work of the American Guernsey Cattle Club. H. V. Cory, instructor in poultry husbandry in Rutgers College, has been appointed instructor in poultry husbandry beginning July 1.

Idaho Station.—Ramsay M. Walker, of Wallace, has succeeded Herman J. Rossi as a member of the State Board of Education.

The semi-monthly Agricultural Newsletter which heretofore has been sent only to newspapers is now being sent to the entire station mailing list. Through this Newsletter frequent announcement is made of available and new publications, which are now sent out only in response to direct request.

The limited area of the State in which corn can be successfully grown necessitates the extensive use of crops other than corn for silage purposes. The station is entering upon its second year of experimentation with mixtures of legumes and small grains for the silo. Valuable feeding data were obtained last year from the college dairy and beef herds with wheat and vetch and with oat and pea silage in comparison with corn ensiled alone.

The department of agricultural chemistry has entered upon an investigation of the chemical changes which these crops undergo in the silo. The work will have for its immediate object the determination of the end products of carbohydrate fermentation and of the characteristic nitrogen compounds which constitute the total crude protein. A beginning is also being made in the field of animal nutrition. The work is under the immediate supervision of Ray E. Neidig, recently of the Iowa College, and of H. P. Fishburn, who is now at the University of Missouri for advanced work in physiological chemistry.

The influence upon quality in wheat of a crop rotation that will make available large quantities of soil nitrogen is the primary object of an extensive series of field plats just being initiated. Previous experiments at one of the substations has emphasized a distinct relationship between available soil nitrogen and the protein content of the matured grain. It is believed that the series of experiments just initiated will eventually answer questions relative to the possibility of producing in the Palouse country a better quality of milling wheat.

Illinois University and Station.—The new genetics building is completed, and experiments with about 1,500 mice are in progress as to the transmission of characters in animals. Plans are under way for a horticultural field laboratory.

Thomas J. Burrill, Ph. D., LL. D., professor of botany emeritus, died in April at the age of 77 years. Dr. Burrill came to the university within a month after its opening, serving continuously until his retirement in 1912. During this long period he had filled the following positions: Assistant professor of natural history, 1868–1870; professor of botany, 1870–1912; professor of horticulture, 1870–1903; botanist of the station, 1888–1903; dean of the college of science, 1878–1884; dean of the general faculty, 1894–1901; dean of the graduate school, 1894–1905; vice-president of the university, 1879–1912; and acting president for various periods aggregating nearly five years.

Michigan College.—A gift of $100,000 has been made by R. E. Olds for the rebuilding of the engineering building destroyed by fire March 5. The new structure is to be known as the R. E. Olds Hall of Engineering.

Minnesota University and Station.—The former divisions of economic entomology and of vegetable pathology and botany have been given the titles of (1) economic zoology and (2) plant pathology and agricultural botany, respectively.

C. W. Glotfelter, of Waterville, has been appointed a member of the board of regents, vice B. F. Nelson, whose term expired April 1. F. B. Snyder and Pierce Butler, whose terms expired at the same time, were reappointed.

R. M. West, assistant professor of agricultural chemistry and assistant chemist, has resigned to become secretary of the State Department of Agriculture, effective on March 1. Miss Mildreth J. Haggard, chemist in animal nutrition investigations, resigned to take effect May 1. J. J. Willaman has been promoted from instructor to assistant professor of agricultural chemistry and placed in charge of the section of agricultural analysis. C. H. Bailey, cereal technologist of the station, has been given a year's leave of absence, in order to take up work in the research laboratory of the State Grain Inspection Service.

Nebraska University and Station.—W. W. Burr, of the Office of Dry-land Agriculture of this Department, has been appointed professor of agronomy and head of the department of agronomy, beginning July 1.

New Jersey College and Stations.—Dr. Julius Nelson, professor of biology and biologist since 1888, died February 15 at the age of 58 years. Dr. Nelson was born at Copenhagen, Denmark, and was graduated from the University of Wisconsin in 1881. In 1883 he received the M. S. degree from the same institution, and in 1888 that of Ph. D. from Johns Hopkins University. His best known station work is his long-continued study, under a state appropriation, of oyster culture.

North Dakota Station.—L. R. Waldron, superintendent of the Dickinson substation since 1905, has been appointed in charge of the crop-breeding work at the main station and has been succeeded at Dickinson by John C. Thysell.

Texas Station.—T. W. Buell, superintendent of the Denton substation, has resigned to engage in farming. He has been succeeded by V. L. Cory, superintendent of the Lubbock substation, and he in turn by R. E. Karper, assistant agronomist of the Oklahoma College and Station.

Washington Station.—An additional substation has been established at Lind, Adams County, to be known as the Adams Branch Station. This substation is planned especially for studies in dry-land agriculture and was acquired through appropriations from the county board of commissioners, supplemented by gifts from a railway company and various individuals. A foreman's cottage, barn, and laboratory and office building have been erected, and crop and tillage experiments are under way. M. A. McCall has been appointed superintendent of the substation.

A temporary substation has also been opened at Winthrop for the study of animal diseases. A laboratory for the purpose has been erected.

Wisconsin University and Station.—The department of experimental breeding has recently occupied its new barn which has been especially designed for experimental purposes. The barn contains accommodations for about 20 cattle and has a floor space 36 by 63 feet.

The demonstration farm at Sparta is to be transferred to Hancock, where a site of 25 acres, provided by the Hancock Advancement Association, is to be utilized.

W. J. Geib, of the Soil Survey of this Department, has been appointed assistant professor of soils.

Association of American Agricultural Colleges and Experiment Stations.—The next meeting of this association will be held at Washington, D. C., November

15 to 17. It is expected that special prominence will be given on the general program to a discussion of some of the administrative features of the Smith-Lever Act, the development of home economics work, especially along extension lines, and the enlargement of military service in the land-grant colleges under the recent Federal legislation for increasing the military resources of the country.

National Agricultural Society.—This society was formally organized in New York City, April 27, the purpose stated in press reports being that of serving as the mouth-piece of the farmers of the United States in agricultural questions of nation-wide interest. Hon. James Wilson, of Iowa, former Secretary of Agriculture, was elected president; Theodore N. Vail, of Vermont, vice-president; G. Howard Davison, of New York, chairman of the executive committee; and T. Coleman DuPont, of Delaware, John A. Spoor, of Chicago, R. V. Lindabury, of New Jersey, Hon. William H. Moore, of New York, Governor H. C. Stewart, of Virginia, Senator James W. Wadsworth, of New York, and Fairfax Harrison, president of the Southern Railway, as members of the board of directors.

The society has begun the publication of the *Agricultural Digest*. This is a monthly which summarizes the important happenings in agriculture, and contains announcements, notes, signed editorials by a number of prominent agricultural workers, and similar material.

Southern States Conference on Secondary Agricultural Education.—The second conference on secondary agricultural instruction for the Southern States was held at New Orleans, La., April 17. The attendance aggregated about fifty, all the Southern States being represented. The conference was a joint undertaking between the States Relations Service of this Department and the U. S. Bureau of Education, and included professors of secondary education in state universities as well as supervisors of secondary agricultural instruction in state departments of public instruction.

C. H. Lane summarized some of the more important happenings in connection with teacher training that had taken place at similar conferences held in the North Atlantic and North Central States. He also stated that the aim of this conference was to work out a tentative course which may be taken as a guide for training teachers in agriculture, and when revised and tested, may be made the basis for licensing teachers in lieu of the present required examinations. The more important features of this course include a minimum for the first two years of agricultural subjects 24 hours, science 24 hours, humanistic subjects 15 hours, electives from agriculture 6 hours, and optional 3 hours. The minimum for the junior and senior years is agricultural subjects 12 hours, sciences 12 hours, humanistic subjects 12 hours, professional (education) 9 hours, special methods in secondary agricultural instruction 12 hours, electives from the foregoing groups 9 hours, and optional 6 hours. The course presented and in general approved by the conference also provided for general courses in the first two years of from 3 to 4 hours in field and forage crops, soils and fertilizers, animal husbandry and dairying, horticulture and forestry, and farm machinery, including shop and farm practice.

The report of the committee on annual conferences and programs, approved by the conference, recommended the continuation of the conferences, which have been found most useful in providing standards in agricultural teaching. It was thought that the conference should hereafter meet with the Conference for Education and Industry in the South, and that its next subject should be The Supervision of Agricultural Teaching. The belief was expressed that the proceedings should be published and distributed as widely as possible. Some action should be taken to insure the adoption of the recommendations of the

conference and to follow up its work. Reports to the Bureau of Education and the Department of Agriculture as to the success of courses tested, with recommendations for modifications or changes, were suggested.

The report of the committee on institutional relations, also approved by the conference, recommended that only four-year college courses, substantially as outlined by the conference, be recognized by state departments of education for professional licenses to teach agriculture in secondary schools without further examination. It was believed that much less work should be required for teachers of agriculture in elementary schools, and that such training should be done in normal schools and secondary agricultural schools. The training of secondary teachers of agriculture, however, it was thought should be done in the agricultural colleges, universities, and other institutions of like grade equipped with full departments of agriculture and education.

A conference with normal schools and secondary schools of agriculture to determine a well defined course in agriculture for teachers in elementary schools was favored.

Necrology.—Prof. George E. Patrick, chief of the dairy laboratory of the Bureau of Chemistry of the U. S. Department of Agriculture since 1901, died at Washington, D. C., March 25 at the age of 64 years. Professor Patrick was a native of Massachusetts and a graduate of Cornell University in 1873 (M. S., 1874). He served as instructor in chemistry in Cornell University from 1873 to 1874, as assistant professor and professor of chemistry in the University of Kansas from 1874 to 1883, as chemist of the Iowa Station from 1888 to 1895, and as assistant professor of agricultural chemistry in the Iowa College from 1890 to 1895, when he began his service with this Department. His work was largely with the chemistry of dairy products, and he had had much service as associate referee and referee of the Association of Official Agricultural Chemists in this connection.

Dr. Harry M. Hart, inspector of cattle at El Paso, Tex., for the Bureau of Animal Industry of this Department, was killed March 9 at Columbus, N. Mex., in the raid by Mexican bandits. He was a 1906 graduate of the college of veterinary medicine of the Ohio State University and had been in the service of this Department since graduation.

The recent deaths are noted of Samuel Johnson, professor of agriculture in the Michigan College from 1880 to 1889, and the first agriculturist of the station; W. W. Cooke, assistant biologist of the Biological Survey of this Department and one of the leading authorities on bird migration and distribution; Charles A. Davis, peat expert of the U. S. Bureau of Mines, and known especially for his studies of peat and related subjects; and Thomas H. Cunningham, inspector of fruit pests for British Columbia.

It is reported that Kenneth R. Lewin, protozoologist at the Rothamsted Experiment Station since 1913, was killed in the European War, March 9.

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